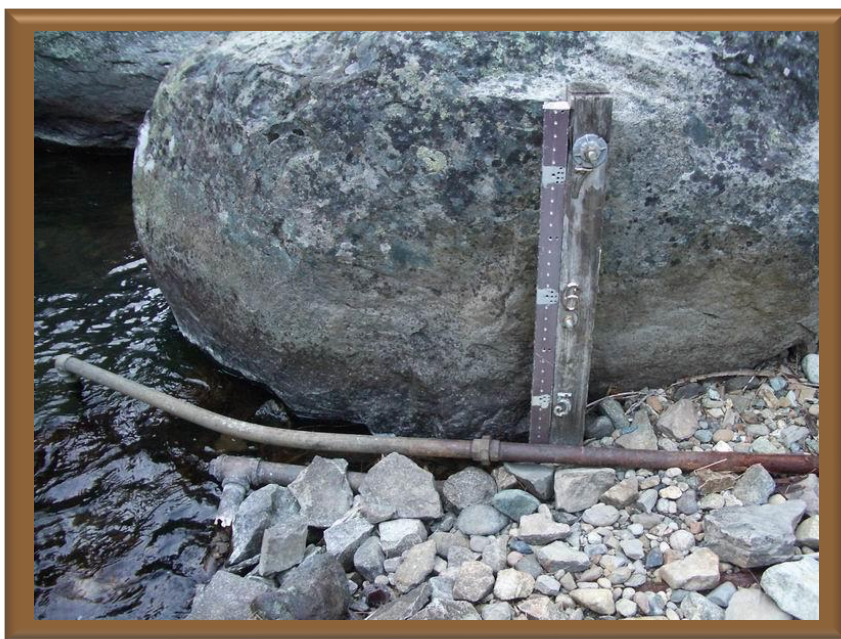


USFS National Flow Gage

Gap Analysis - Region 5



Sacramento River Gage



Prepared by

Dona Horan, Dan Isaak, Charlie Luce, RMRS
February 2013

Commissioned by
Chris Carlson, Katherine Smith, WO

Introduction

The purpose of this study is to review the location of stream gages across the region that are located on, or near, US National Forest System (NFS) lands, and to determine where there are gaps in the distribution of gages across the region.

Questions answered by this analysis include:

- What proportion of the lands in Region 5 are NFS lands?
- What is the extent of the stream network in the region?
- Where are the operational stream gages?
- Where have gages been discontinued?

Data presented in these slides were obtained from the following:

- **Streams:** stream layers (1:100K) were downloaded from the NHDPlus website:
<http://www.horizon-systems.com/nhdplus/data.php>
- **Gages:** 1,957 stream gage locations were downloaded from the USGS website:
<http://waterservices.usgs.gov/rest/Site-Test-Tool.html>

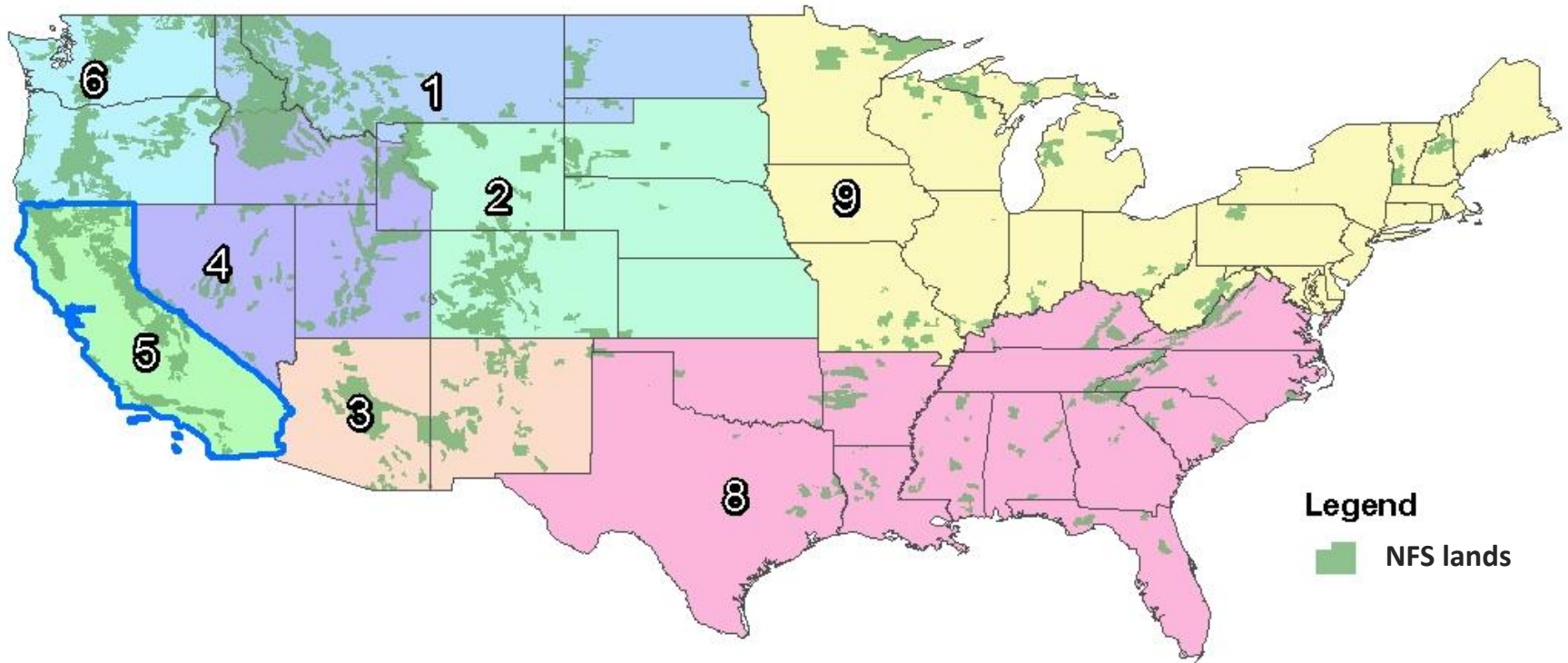
A note about the gage data:


Gage data were downloaded in spring 2012. We assumed that gages having no data beyond 12/31/09 were inactive and were labeled “Historic” in this analysis. Gages that had data past 1/1/10 were considered “Current” in the event their data had not yet been added to the website.

Summary Data

Attribute	On NFS lands in Region 5	All of Region 5	% NFS vs. Region 5
Land Area (km ²)	95,700	409,500	23.4
Stream Length (km) (for basins > 4 km ²)	38,000	157,400	24.1
Number of Historic Gages	338	1,235	27.4
Number of Current Gages	271	722	37.5

USFS Regions in Lower 48



	NFS lands  in R5	All land in R5	% NFS lands in R5
Area (km ²)	95,700	409,500	23.4

River Network in Region 5

Stream Length (km) (for basins > 4 km²)



NFS streams
in R5

All streams
in R5

% NFS streams
in R5

38,000

157,400

24.1

*Shown are rivers draining
basins > 400 km²*

California

Legend

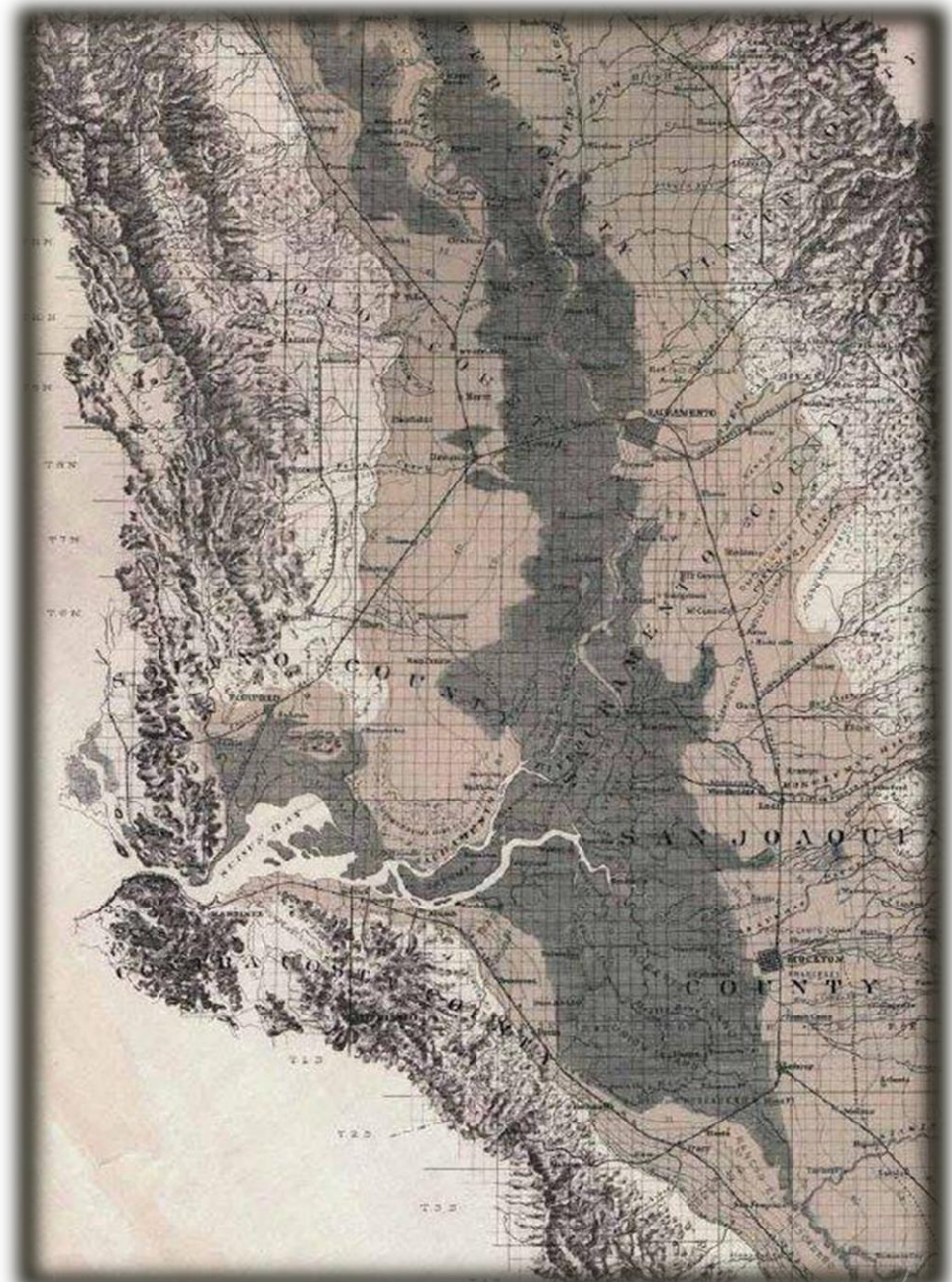


Region 1 boundary



NFS lands

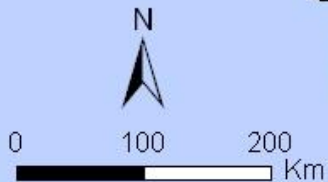
The following slides
show the location of
USGS gages
having discharge data
collected from
1912 - 2012



Historic and Current USGS Stream Gages from 1912 - 2012 (n=1,957)

	Gages on NFS lands	All R5 gages	% Gages on NFS lands
Historic	338	1,235	27.4
Current	271	722	37.5

*Shown are rivers draining
basins > 400 km²*

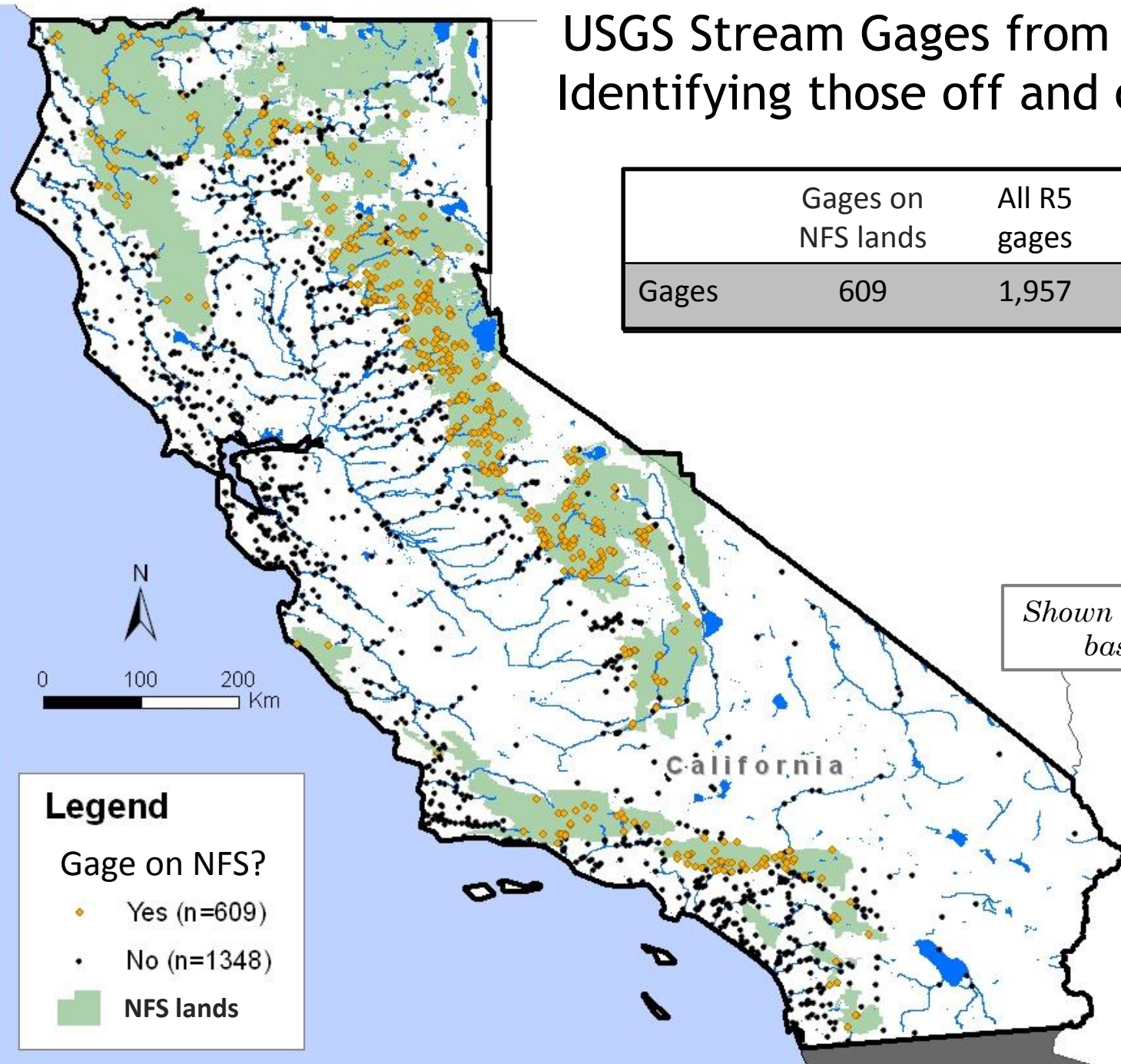


Legend

- Historic <2010 (n=1,235)
- ◊ Current ≥2010 (n=722)
- NFS lands

USGS Stream Gages from 1912 - 2012: Identifying those off and on NFS Lands

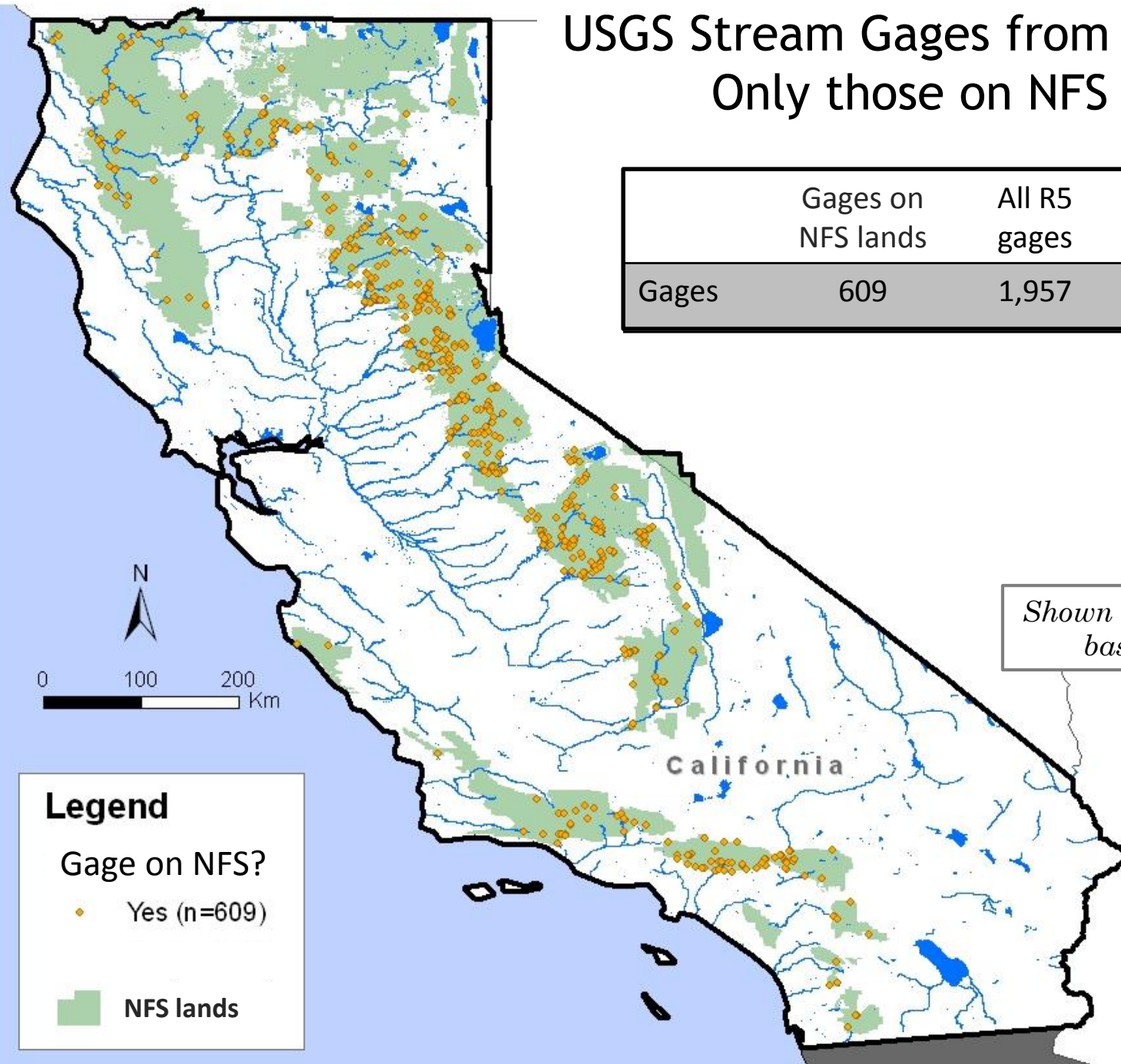
	Gages on NFS lands	All R5 gages	% Gages on NFS lands
Gages	609	1,957	31.1



*Shown are rivers draining
basins > 400 km²*

USGS Stream Gages from 1912 - 2012: Only those on NFS Lands

	Gages on NFS lands	All R5 gages	% Gages on NFS lands
Gages	609	1,957	31.1



USGS Stream Gages Currently Operational: Identifying those off and on NFS Lands

	Gages on NFS lands	All R5 gages	% Gages on NFS lands
Current Gages	271	722	37.5

*Shown are rivers draining
basins > 400 km²*

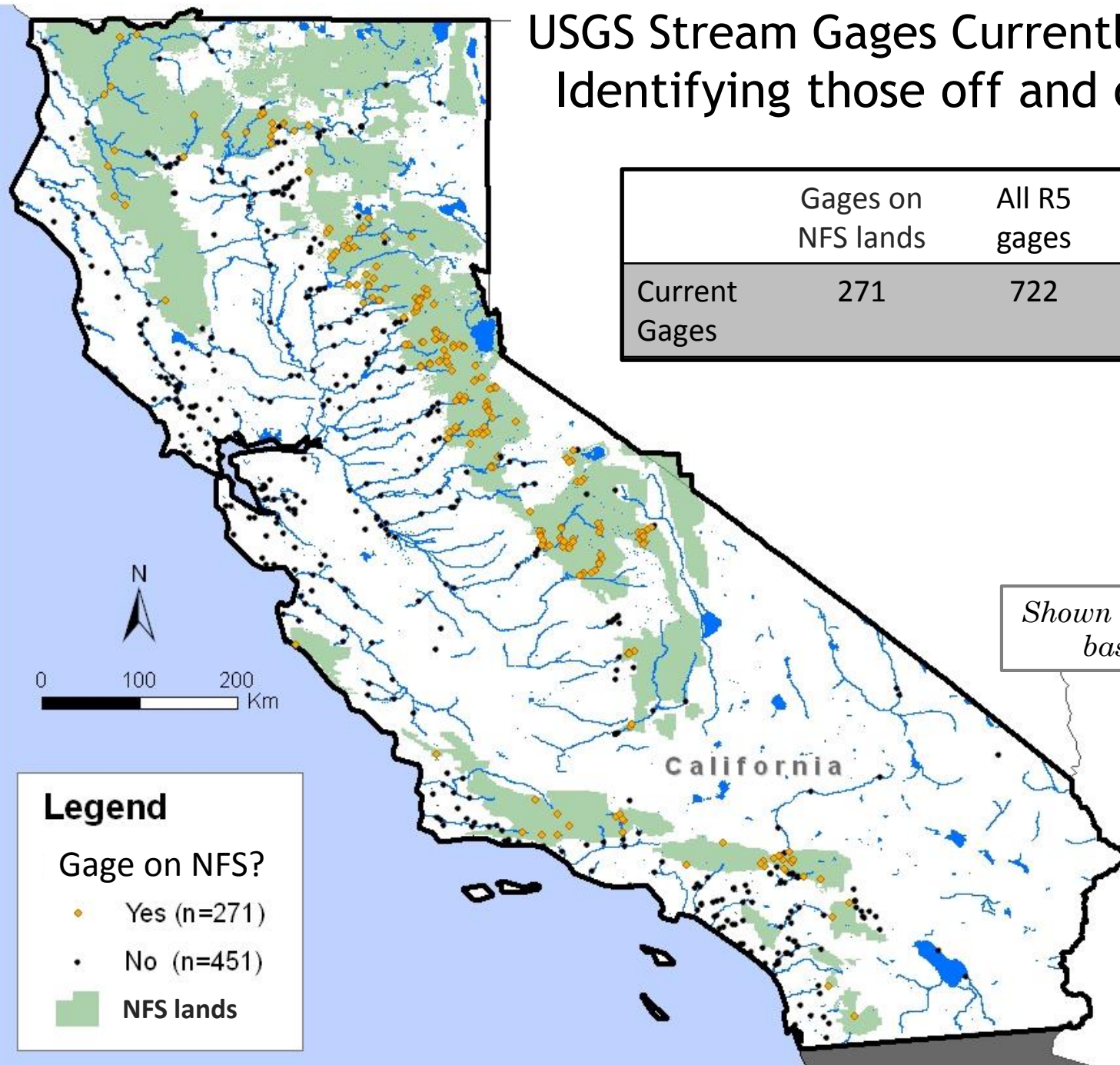
Legend

Gage on NFS?

◆ Yes (n=271)

• No (n=451)

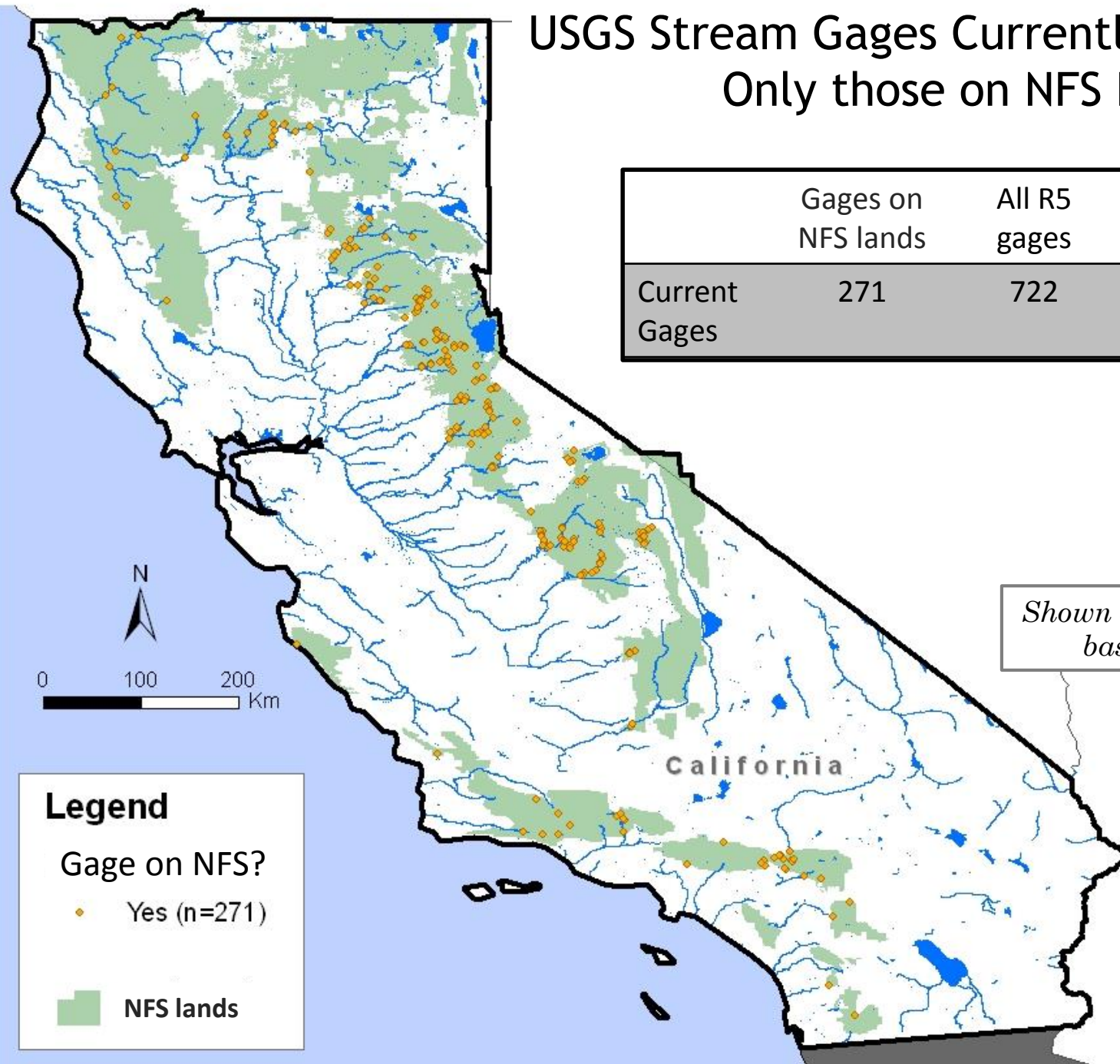
■ NFS lands



USGS Stream Gages Currently Operational: Only those on NFS Lands

	Gages on NFS lands	All R5 gages	% Gages on NFS lands
Current Gages	271	722	37.5

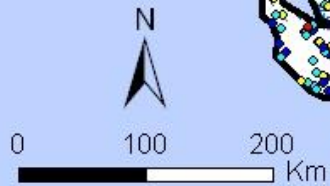
*Shown are rivers draining
basins > 400 km²*



Years in Operation USGS Stream Gages from 1912 - 2012 (n=1,957)

The next slide displays
these data in a bar chart.

*Shown are rivers draining
basins > 400 km²*

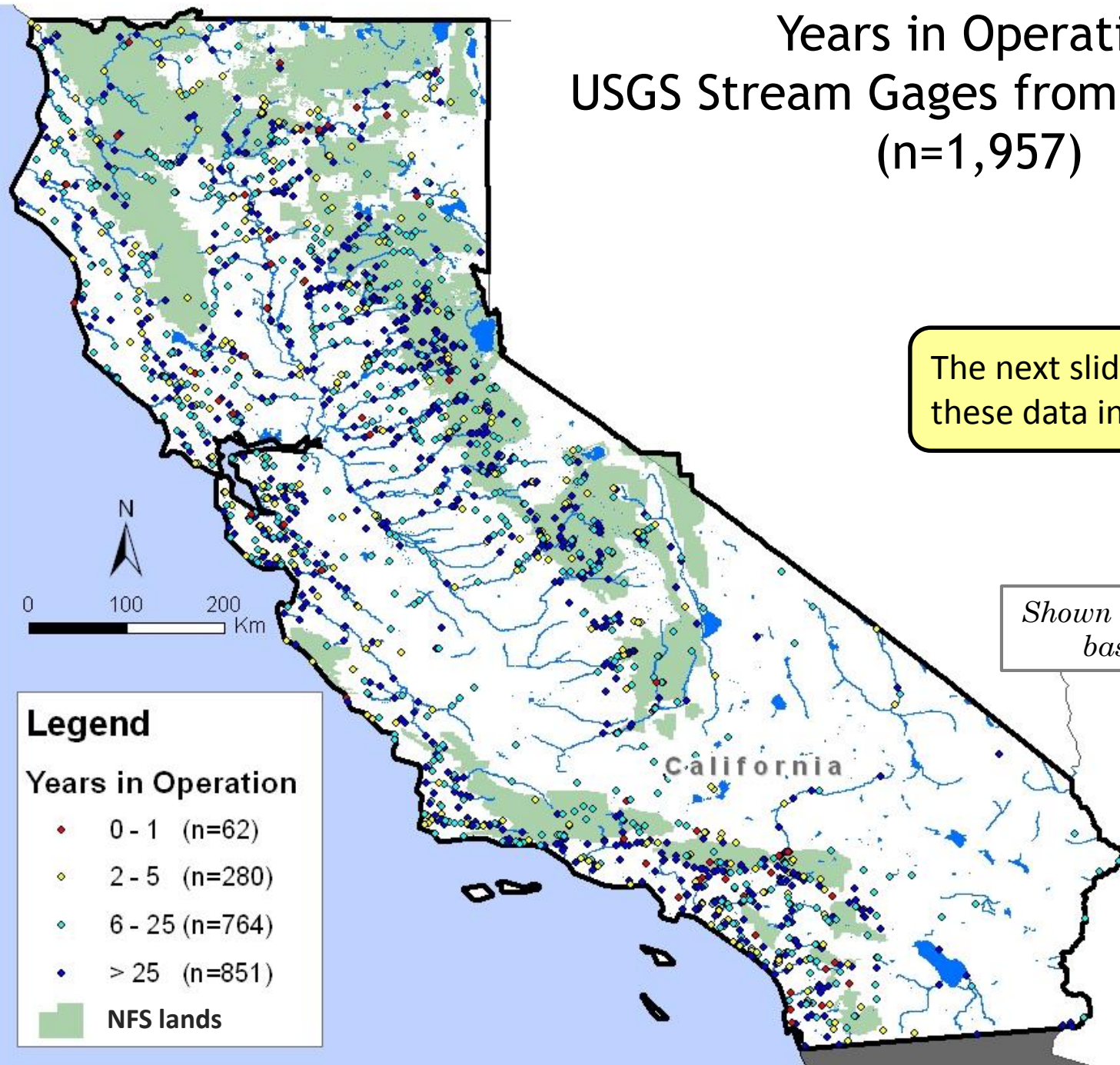


Legend

Years in Operation

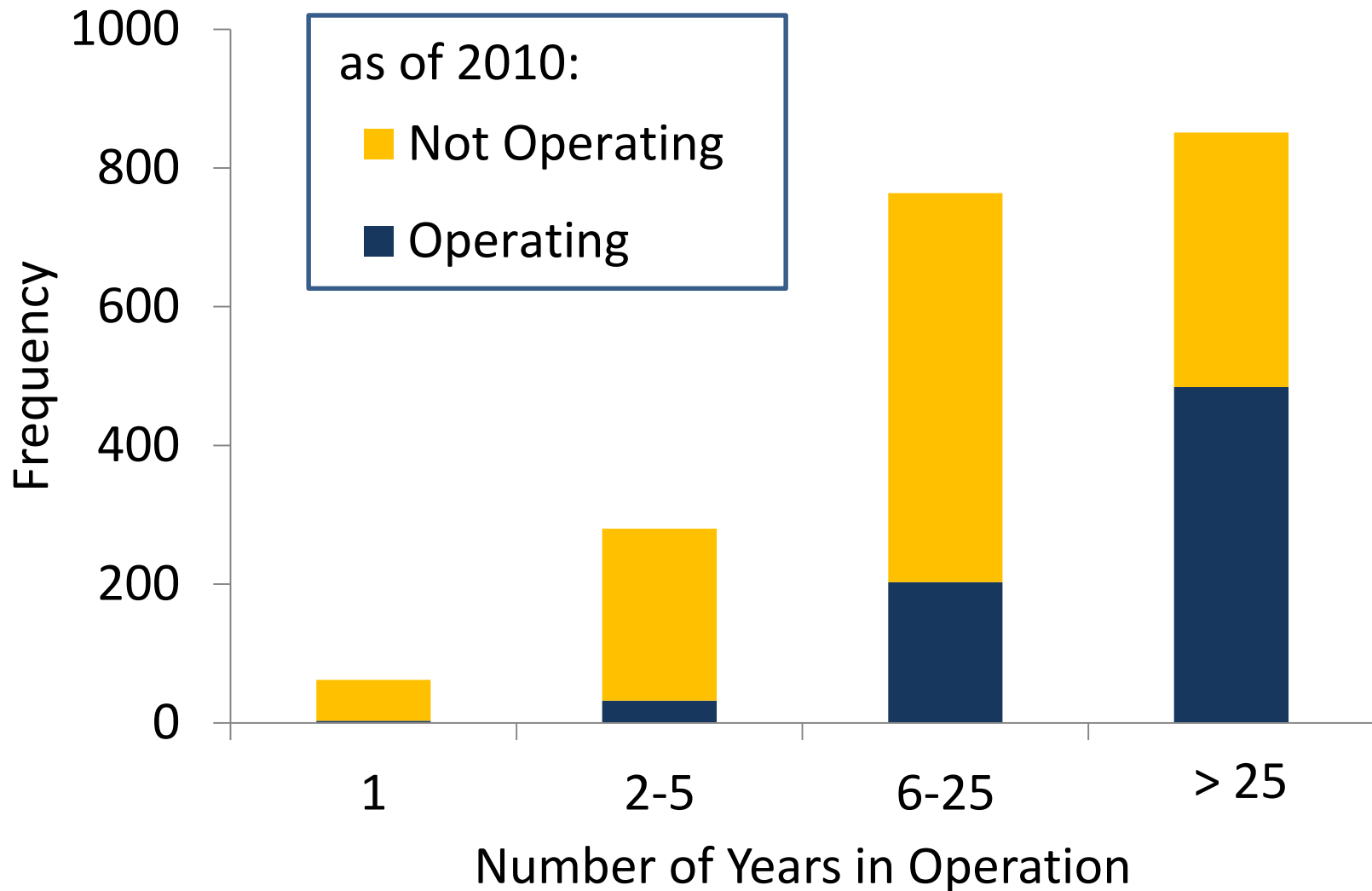
- 0 - 1 (n=62)
- ◊ 2 - 5 (n=280)
- ◊ 6 - 25 (n=764)
- > 25 (n=851)

■ NFS lands

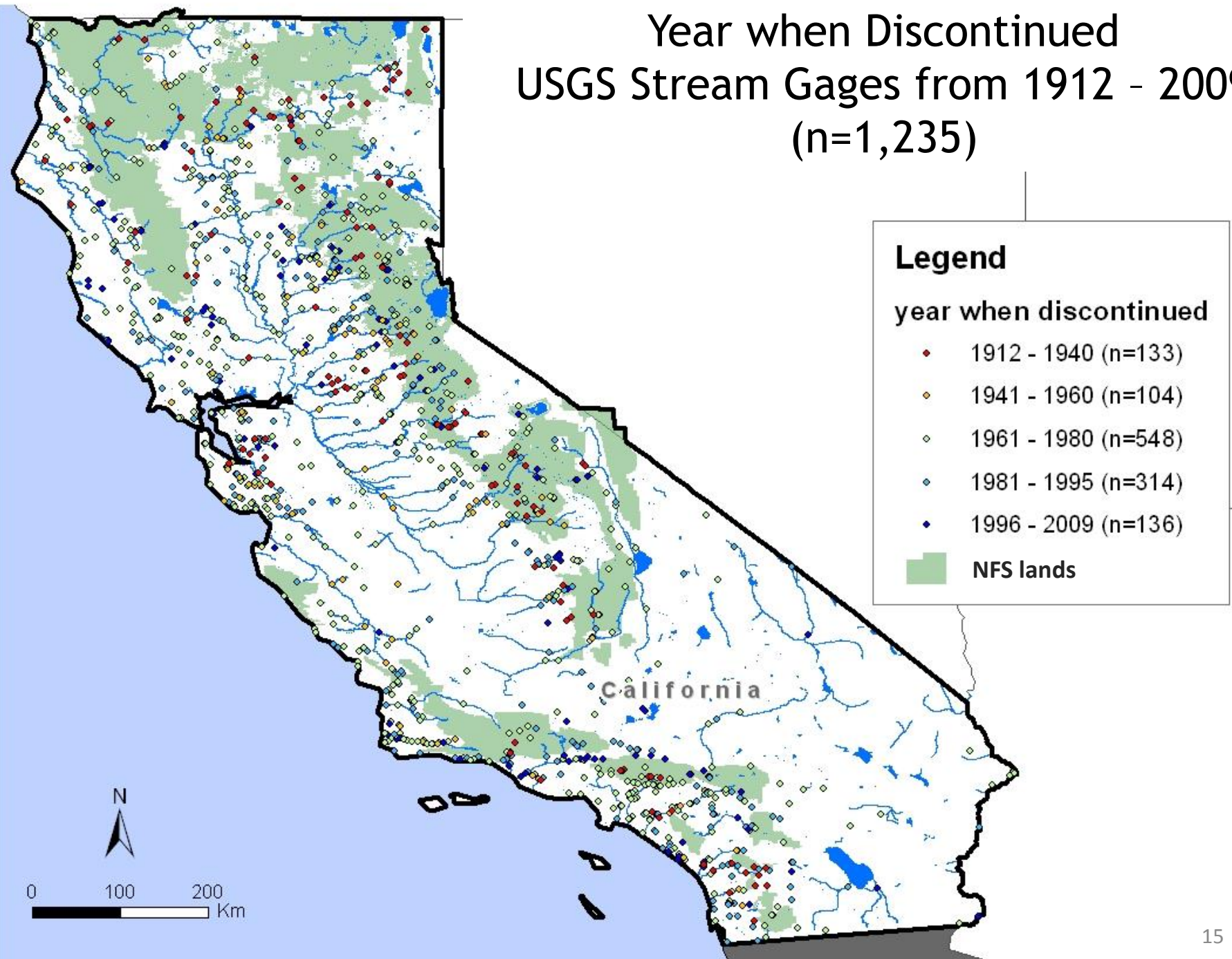


Years in Operation

USGS Stream Gages from 1912 - 2012 (n=1,957)



Year when Discontinued USGS Stream Gages from 1912 - 2009 (n=1,235)



Group 1

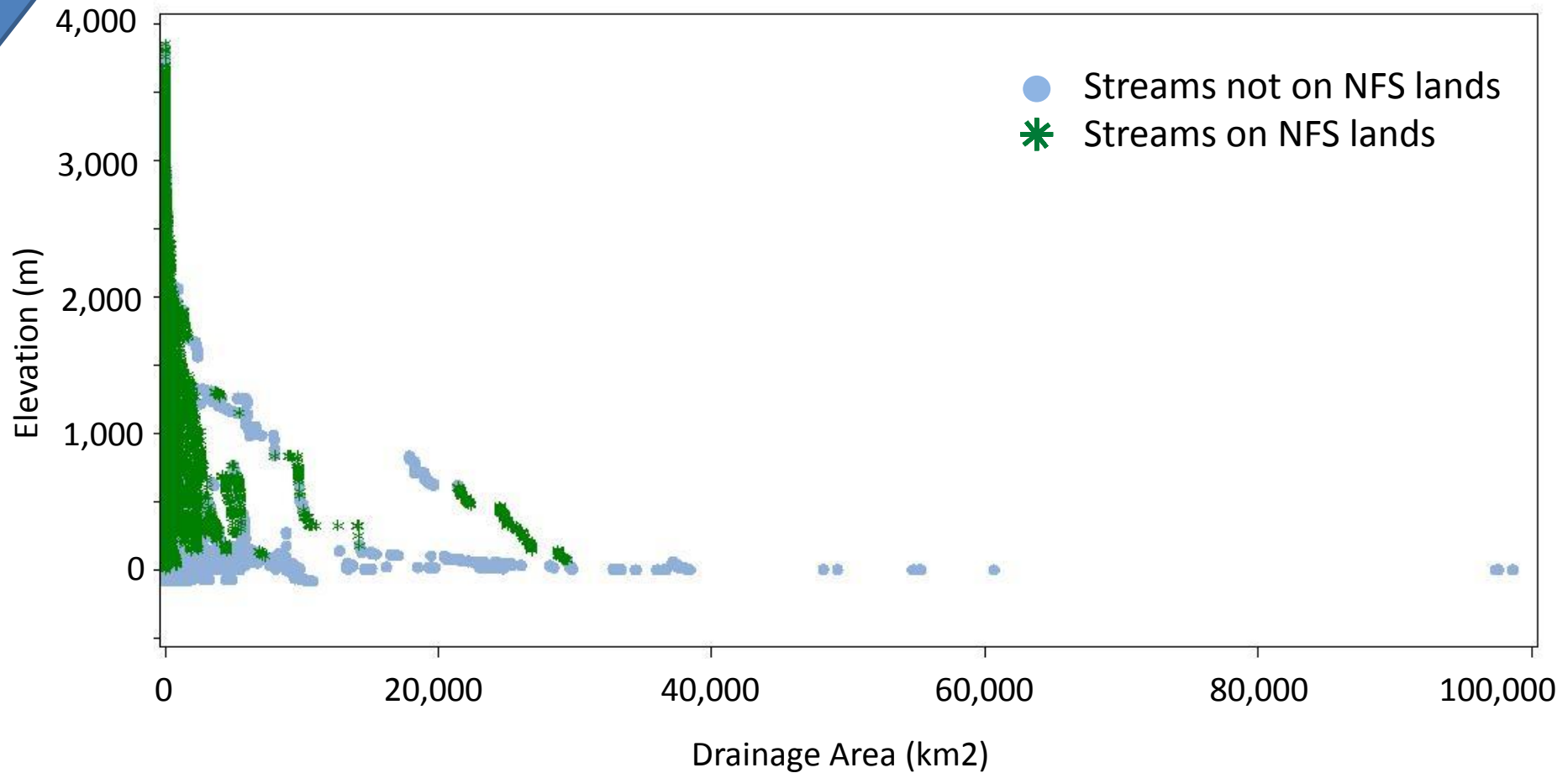
Stream Segments in Region 5

On the following 3 slides, each stream segment within Region 5 is plotted by elevation and drainage area.

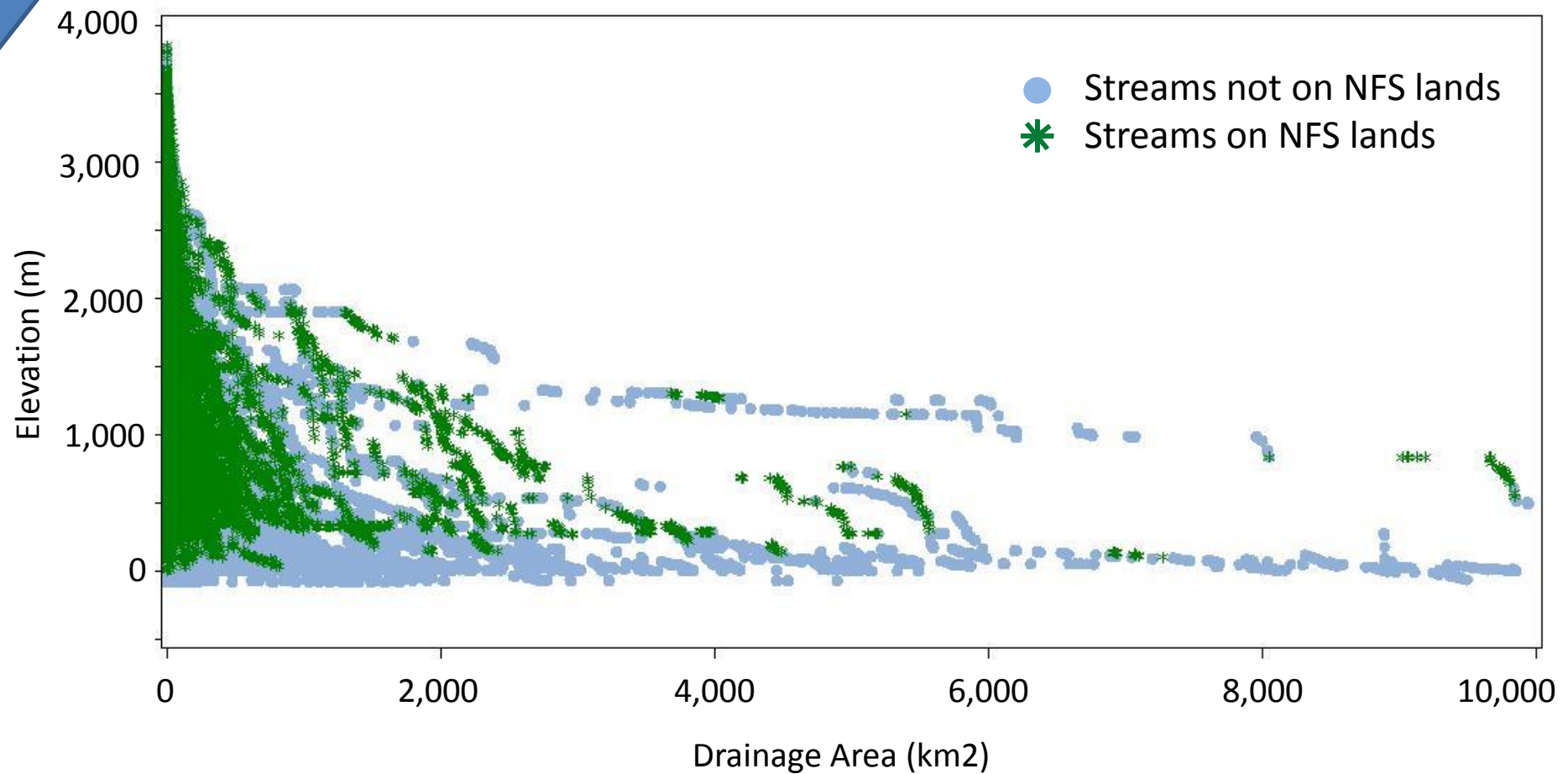
Overlaid on the region's stream segments are the stream segments located on NFS lands.

The only difference between the next few slides is that for each successive slide the horizontal axis will be magnified.

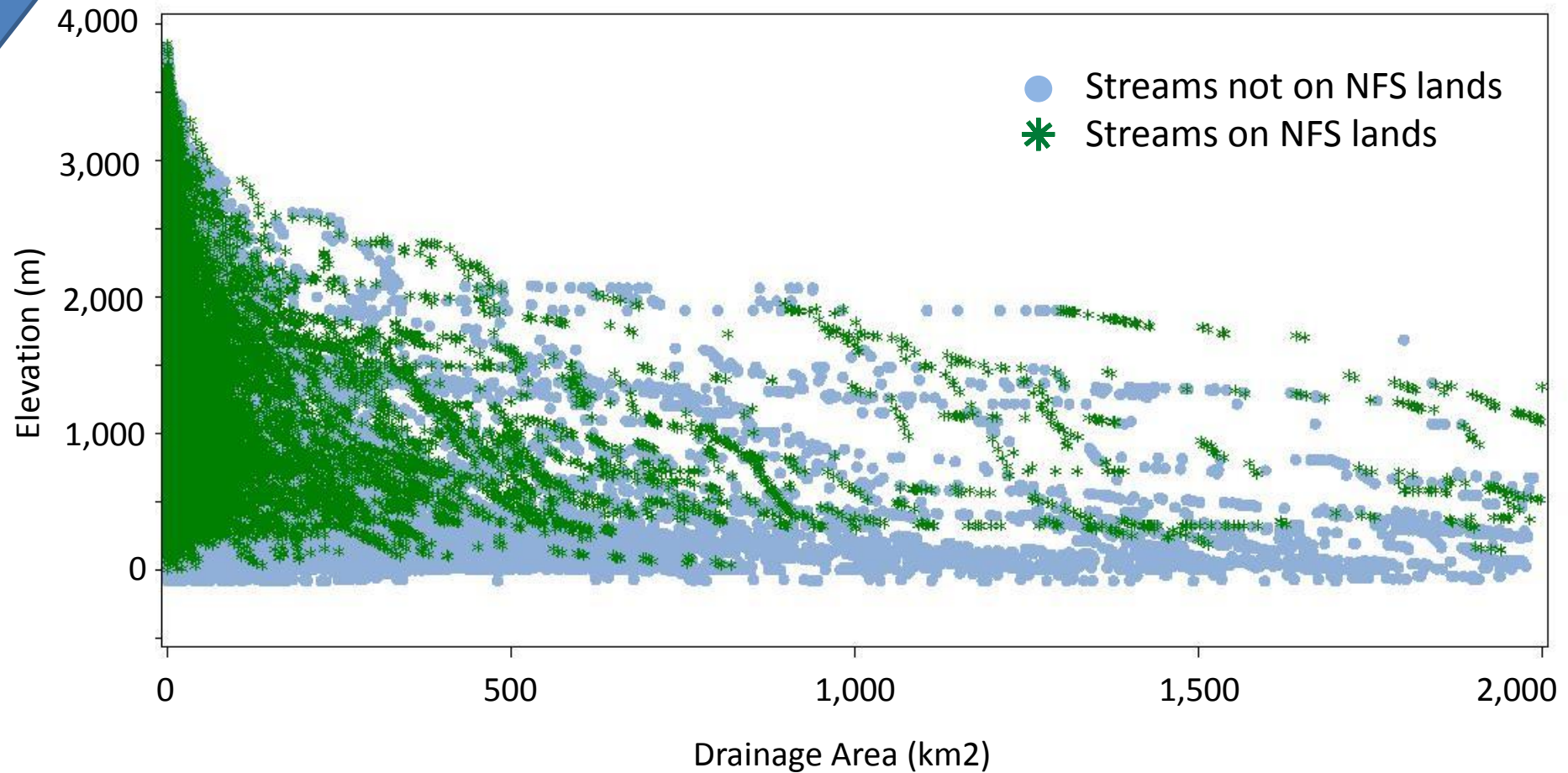
Stream Segments in Region 5



Stream Segments in Region 5



Stream Segments in Region 5



Group 2

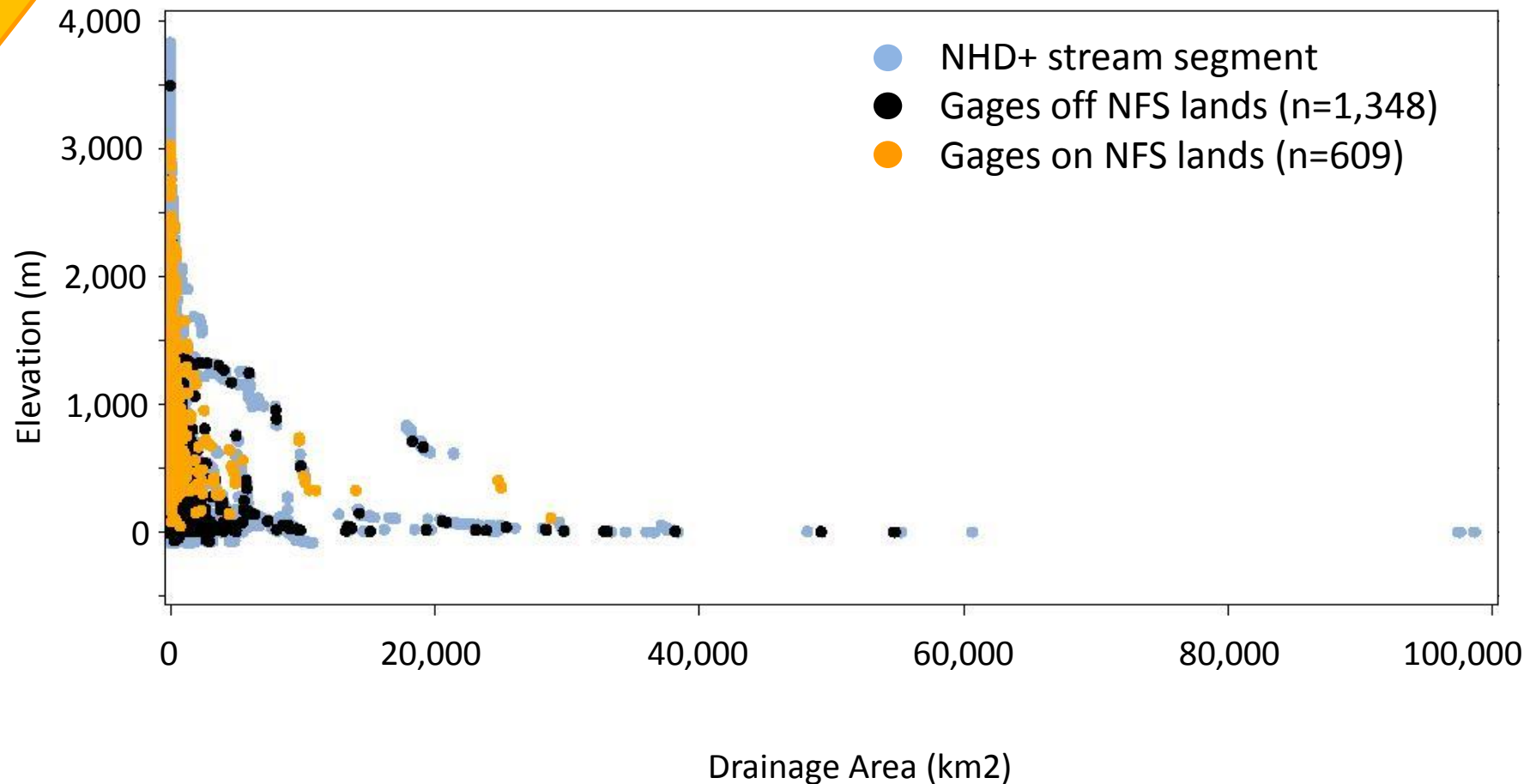
All Stream Gages - off and on NFS Lands

On the following 4 slides, each stream segment within Region 5 is plotted by elevation and drainage area.

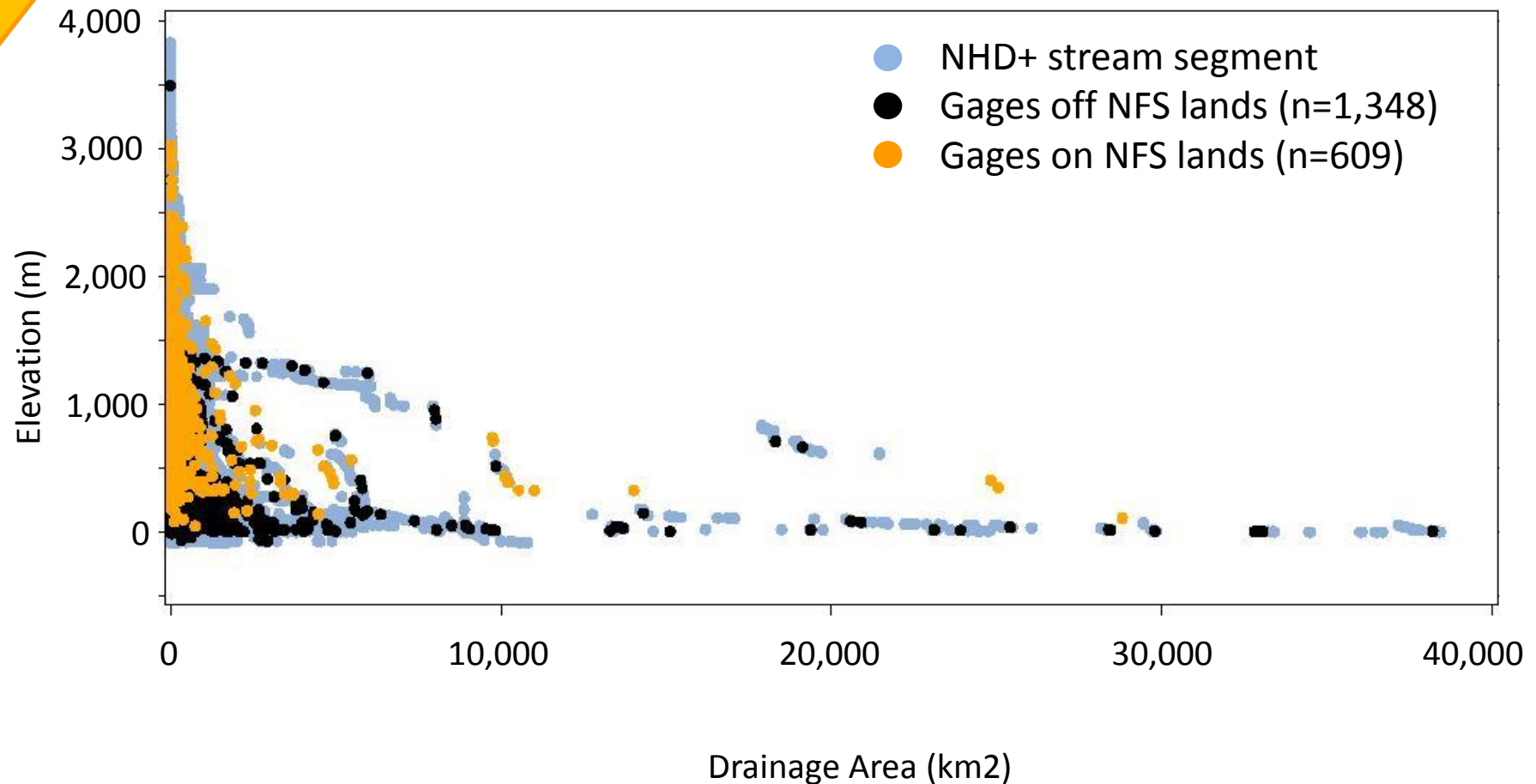
Overlaid on the stream segments are the 1,957 stream gages that are/were active since 1912. There are 1,348 gages that are not on NFS lands and 609 gages on NFS lands.

The only difference between the next few slides is that for each successive slide the horizontal axis will be magnified, as in Group 1.

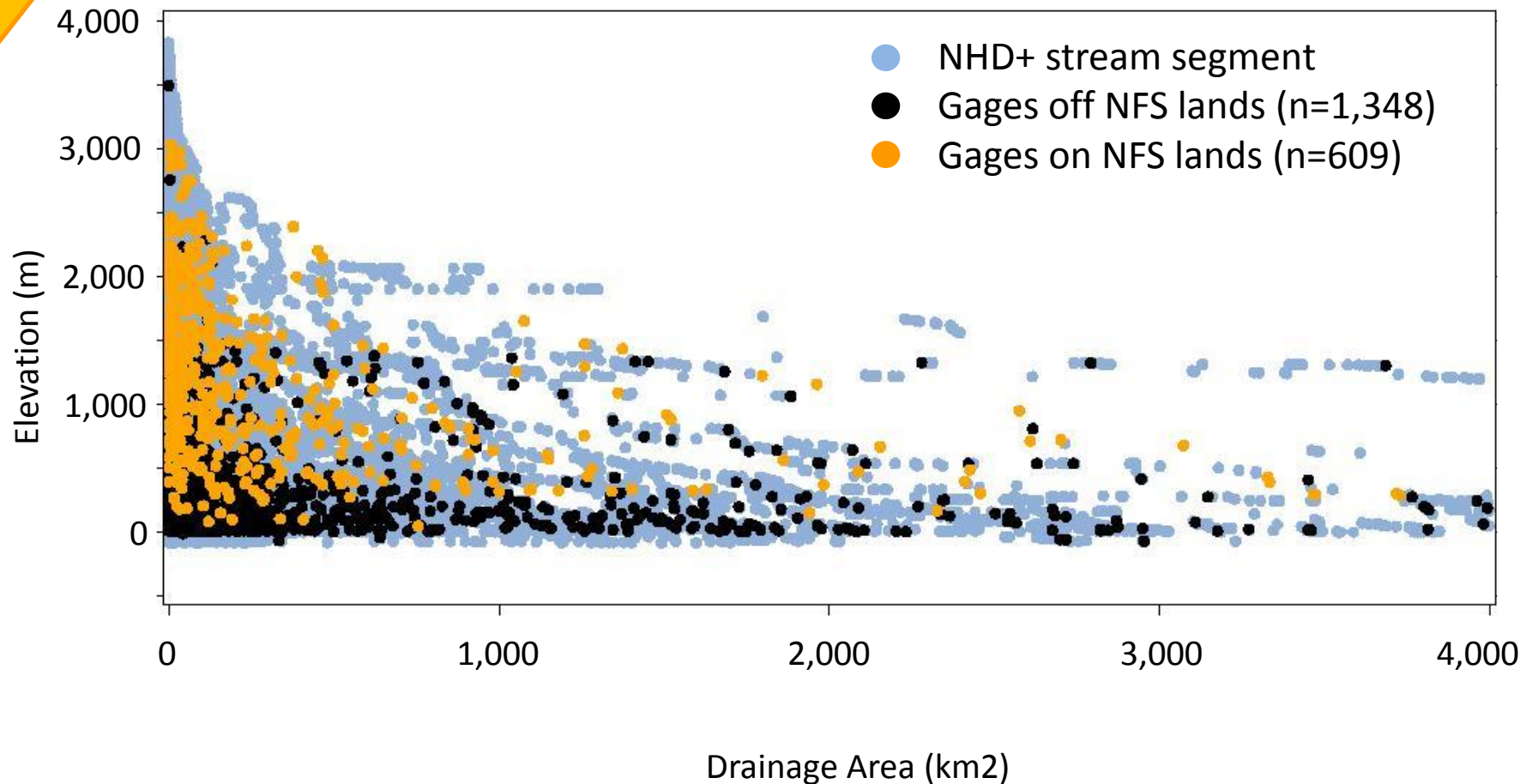
All Stream Gages - off and on NFS Lands



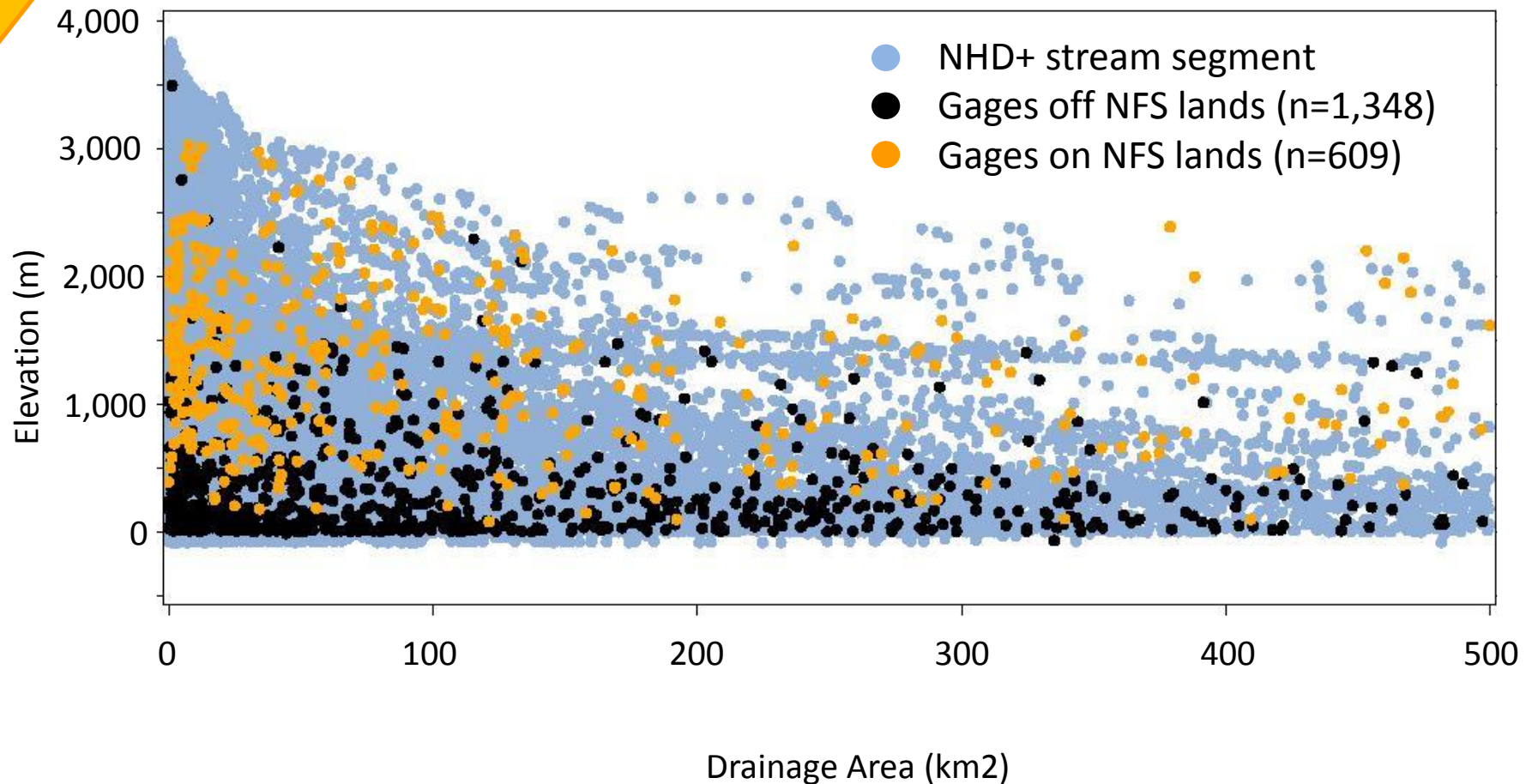
All Stream Gages - off and on NFS Lands



All Stream Gages - off and on NFS Lands



All Stream Gages - off and on NFS Lands



Group 3

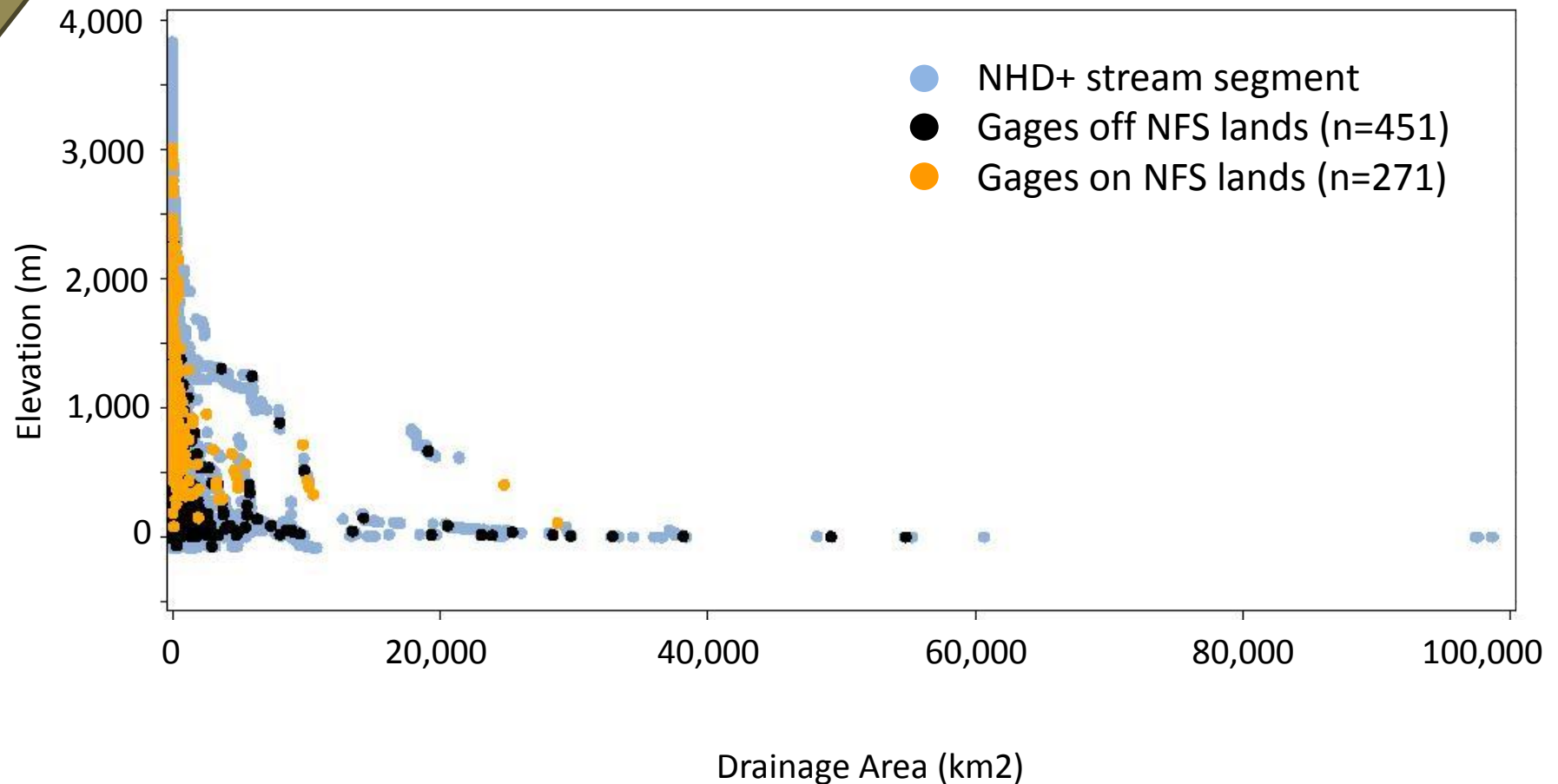
Current Stream Gages - off and on NFS Lands

On the following 3 slides, each stream segment within Region 5 is plotted by elevation and drainage area.

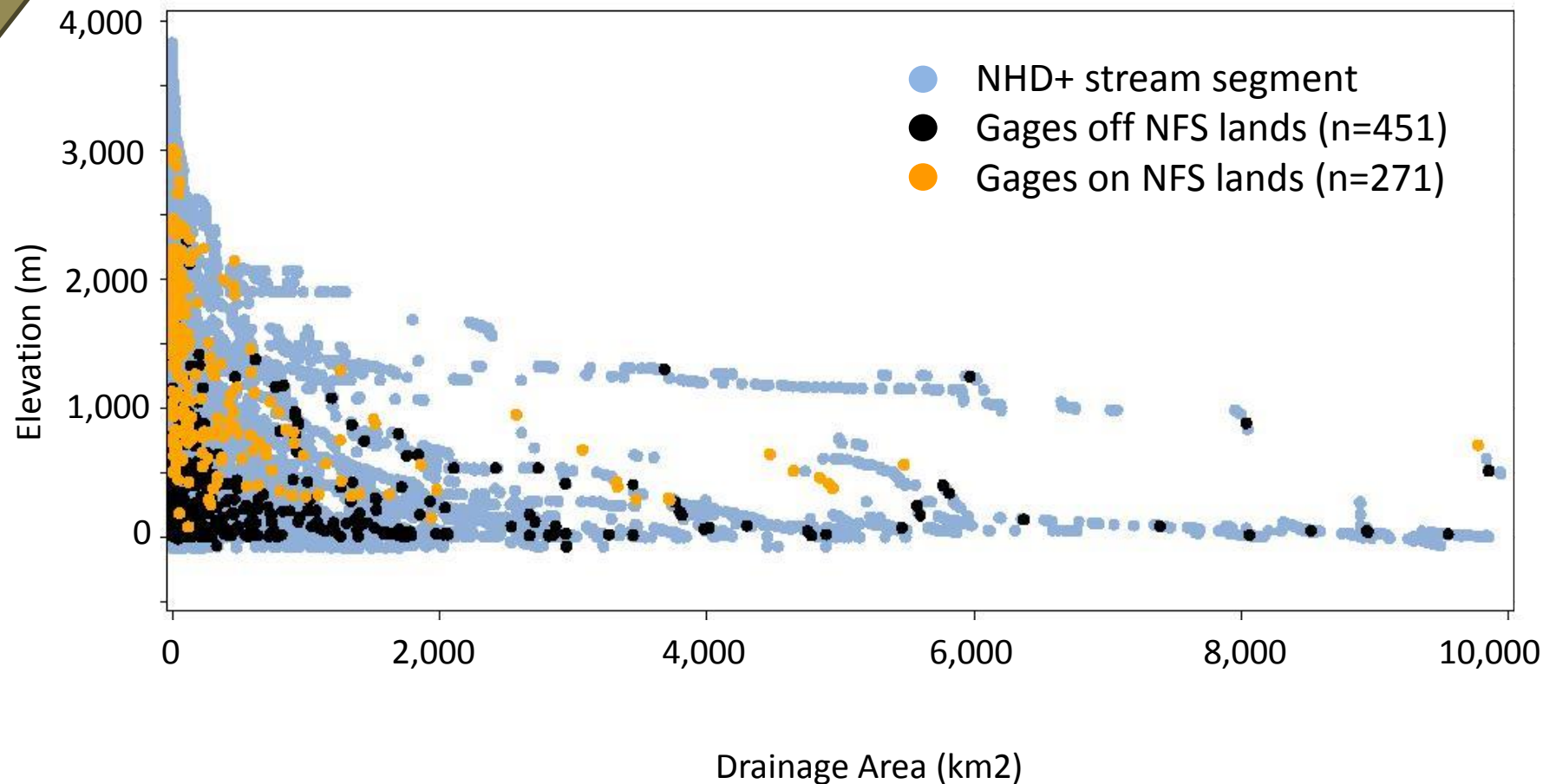
Overlaid on the stream segments are the 722 stream gages that are currently operational, as of January 2010. There are 451 gages operating off NFS lands and 271 gages on NFS lands.

The only difference between the next few slides is that for each successive slide, the horizontal axis will be magnified, as before.

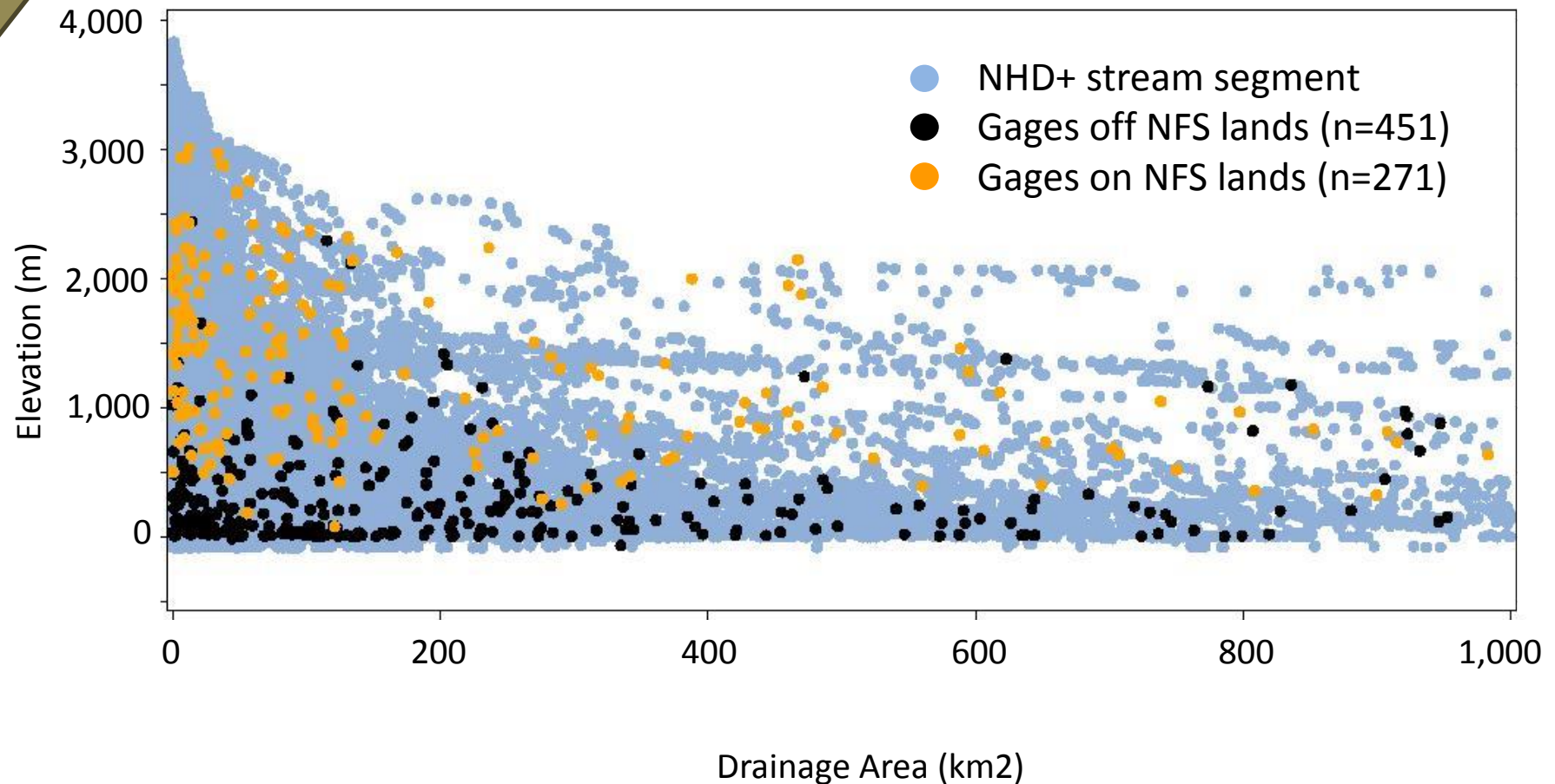
Current Stream Gages - off and on NFS Lands



Current Stream Gages - off and on NFS Lands



Current Stream Gages - off and on NFS Lands



Group 4

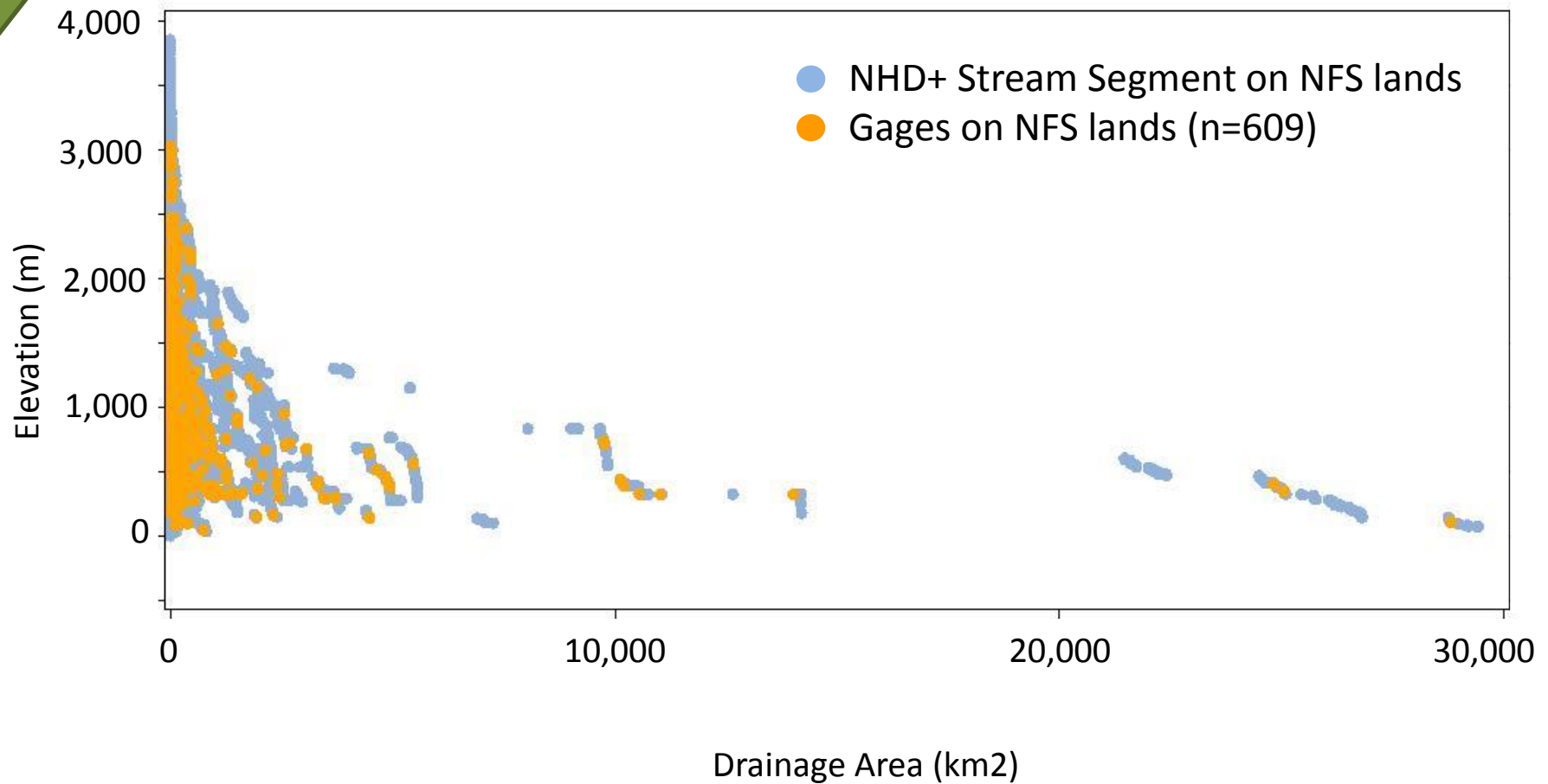
Streams and Historic Gages on NFS Lands

On the following 3 slides, we have plotted only stream segments that are on NFS lands. Overlaid on the stream segments are the 609 stream gages that are/were active since 1912.

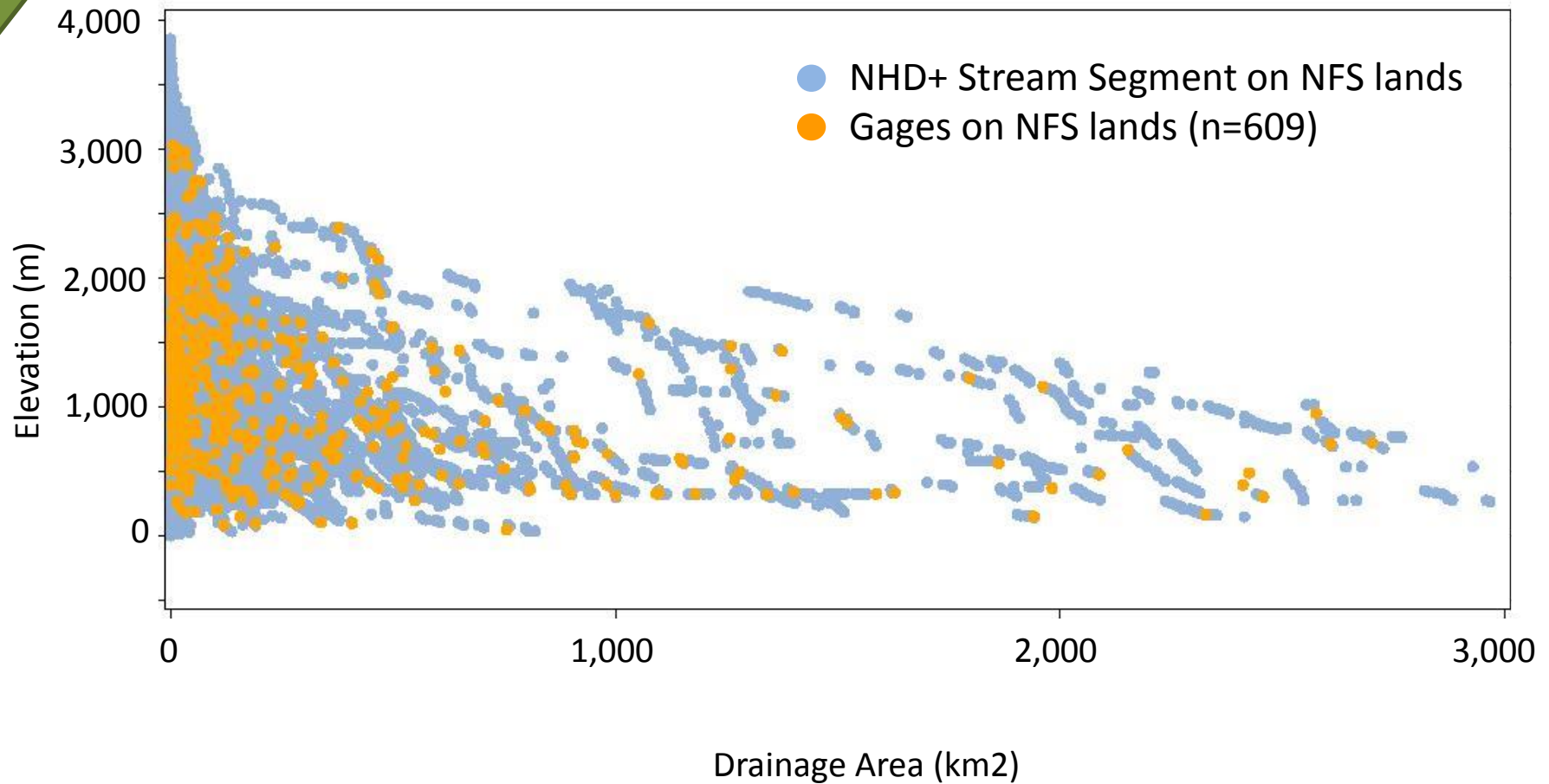
These slides allow us to see the available population of stream segments, relative to the distribution of gages that occur on the Forest, versus Group 2, which showed all stream segments in the entire region.

The only difference between the next few slides is that for each successive slide the horizontal axis will be magnified.

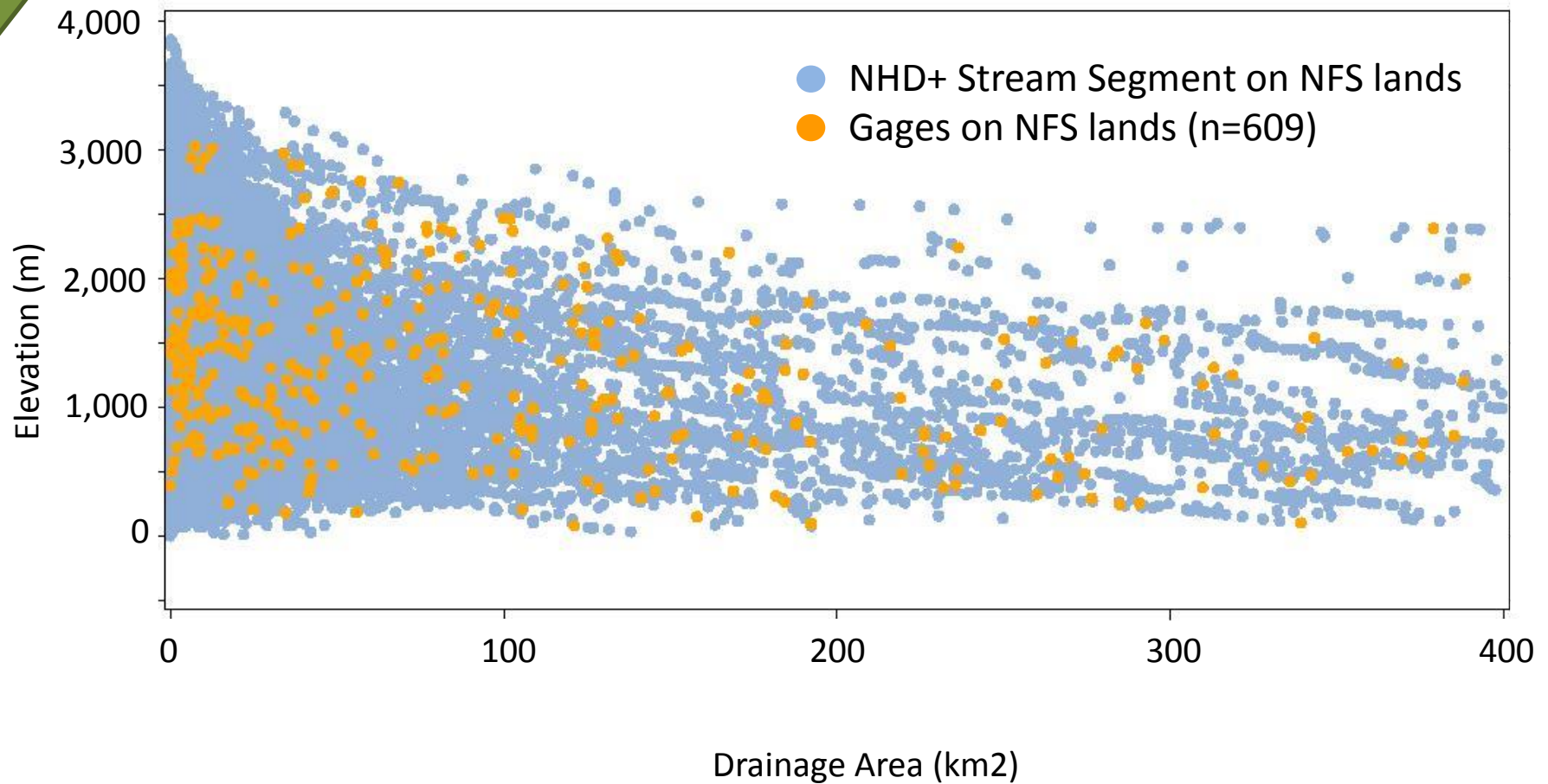
Streams and Historic Gages on NFS Lands



Streams and Historic Gages on NFS Lands



Streams and Historic Gages on NFS Lands



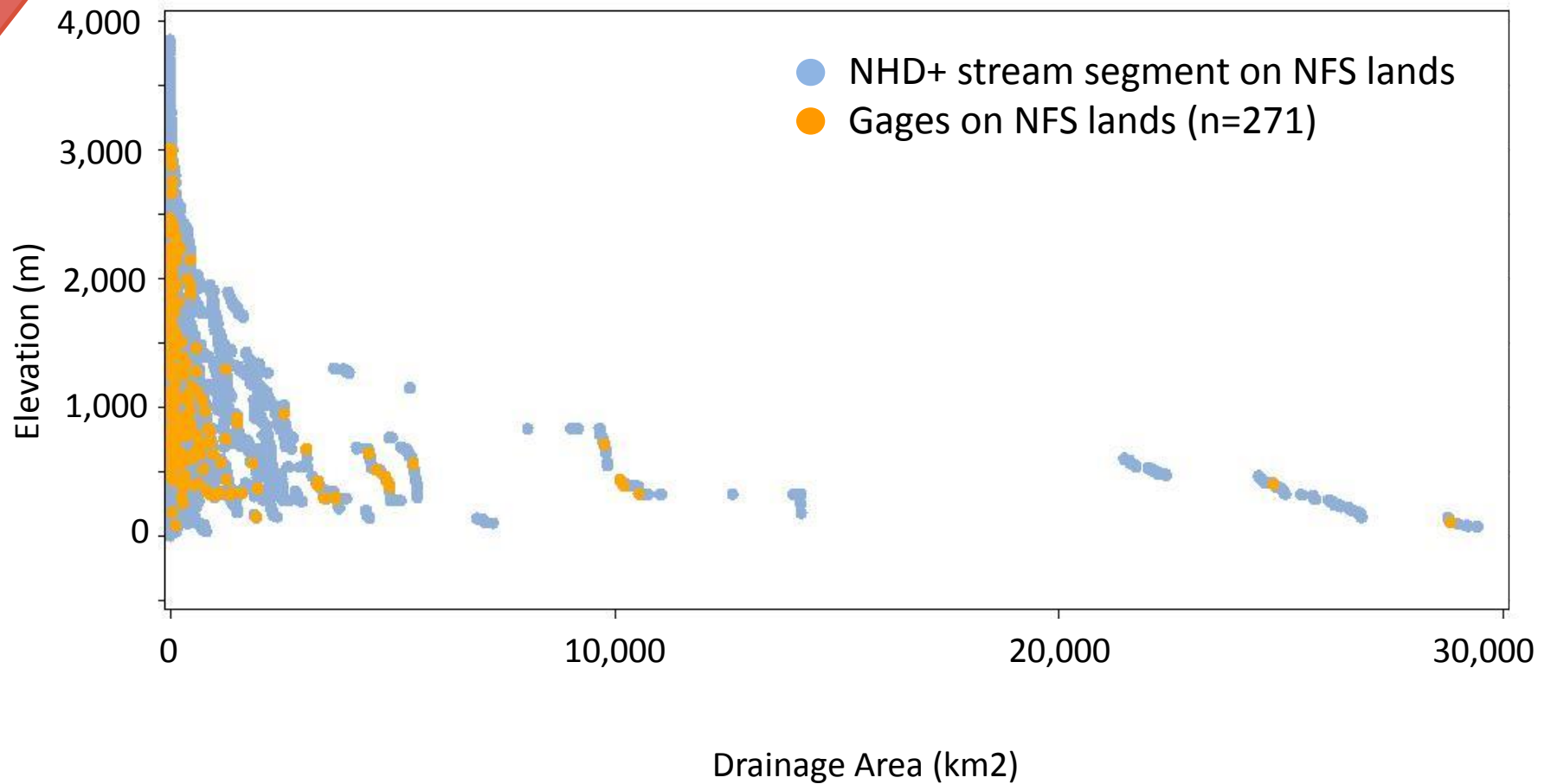
Group 5

Streams and Current Gages on NFS Lands

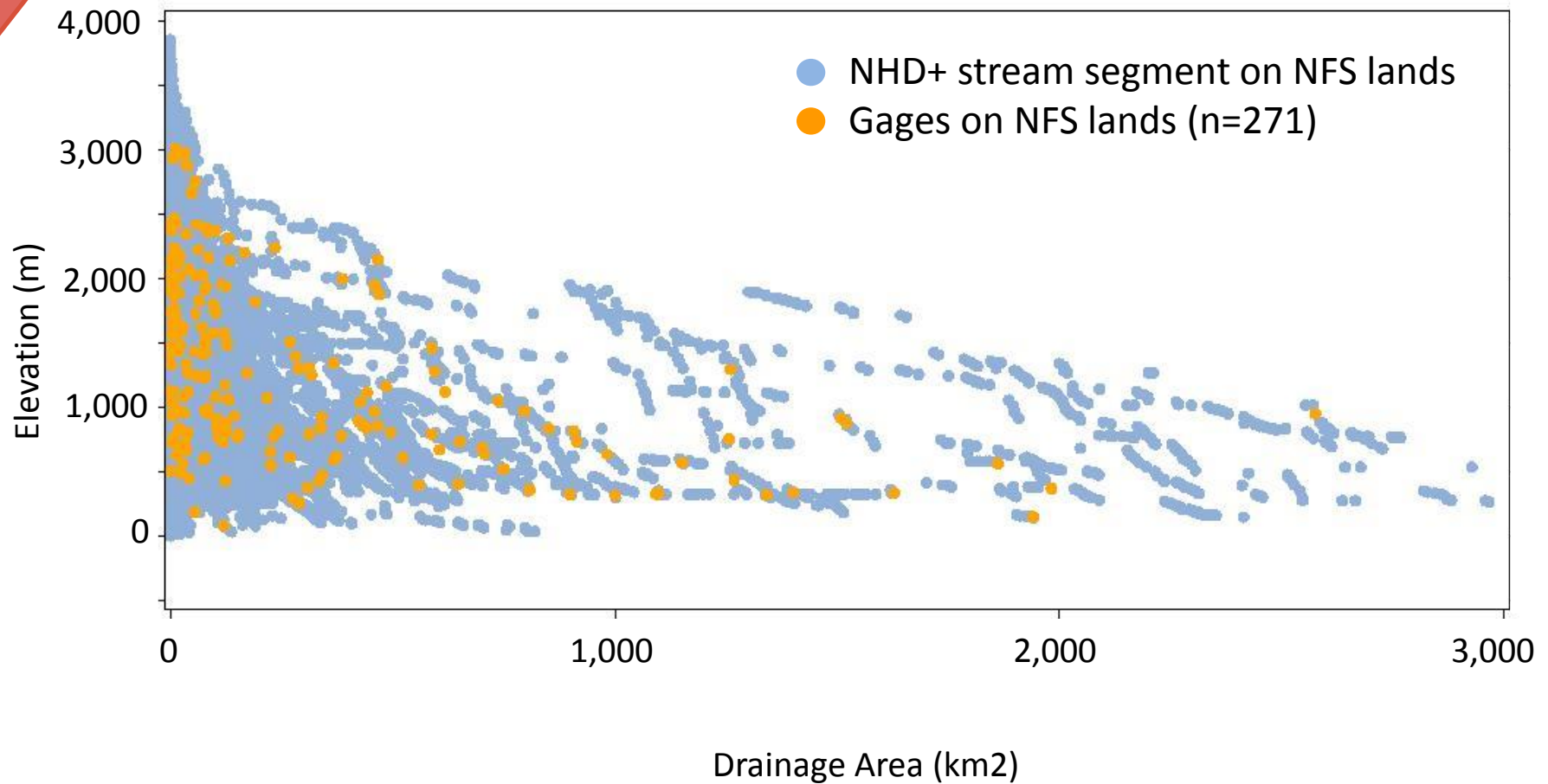
On the following 3 slides, we have plotted only stream segments that are on NFS lands. Overlaid on the stream segments are the 271 stream gages that are currently active as of January 2010.

For each successive slide the horizontal axis will be magnified.

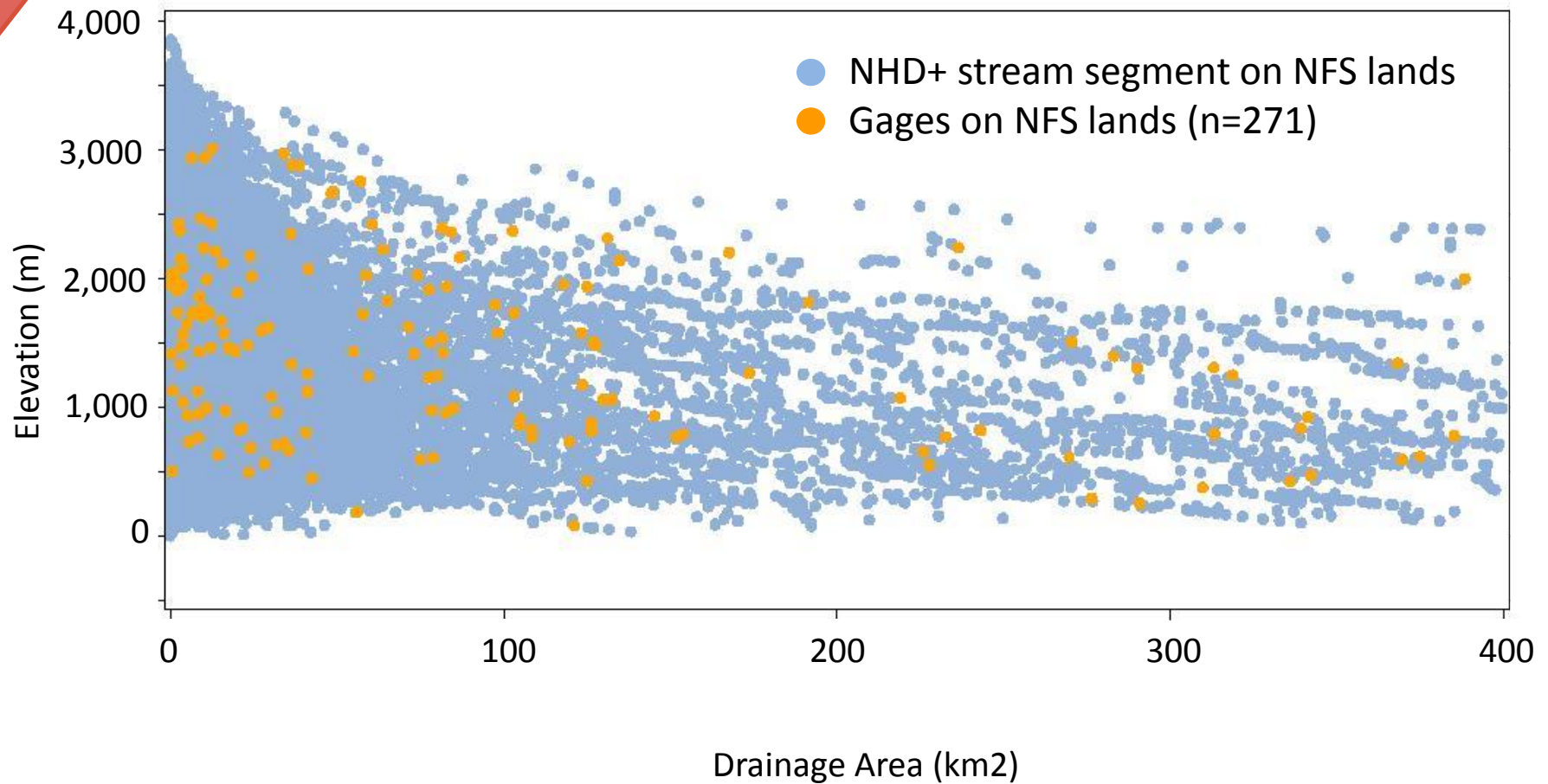
Streams and Current Gages on NFS Lands



Streams and Current Gages on NFS Lands



Streams and Current Gages on NFS Lands



Stream Gages Adjacent to NFS Lands

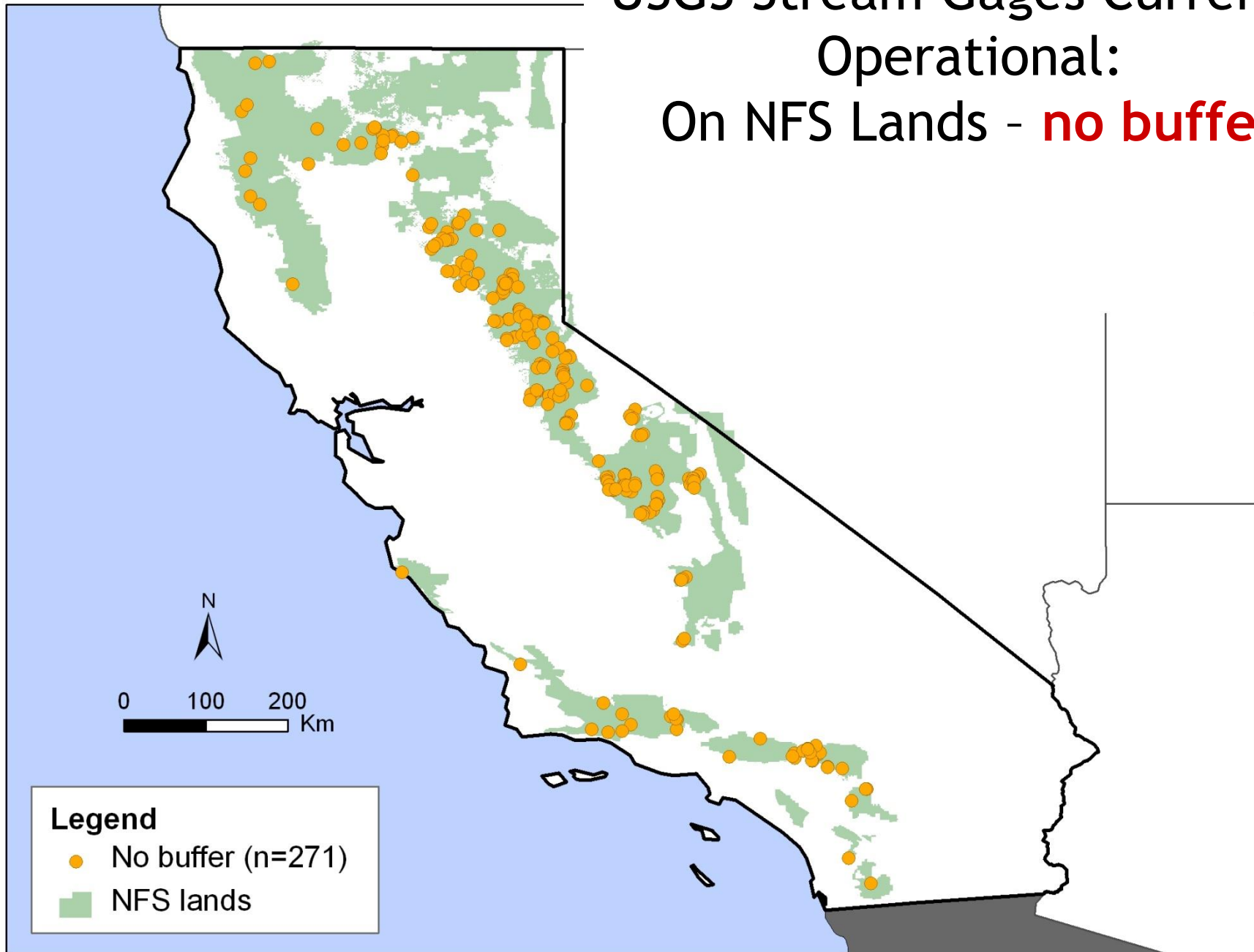
ISSUE

Many stream gages are located on waterways that are downstream of, and not on, a national Forest. In our analysis, only streams gages that touched a Forest boundary, using ArcGIS, were classified as a gage on NFS lands. This type of classification does not account for the tremendous amount of flow that influences gages immediately downstream of a Forest.

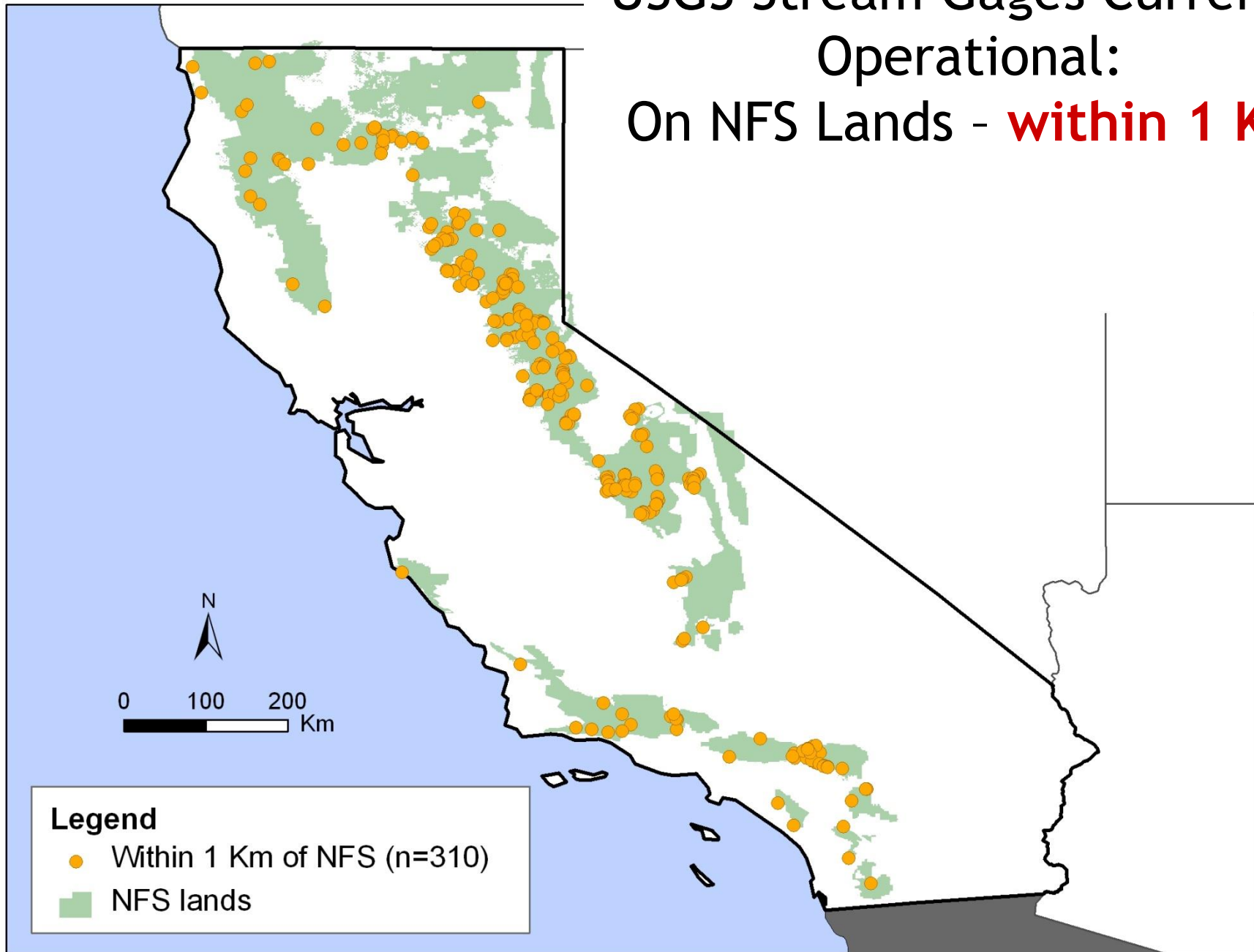
SOLUTION

On the next 6 slides we show the effect of adding a 1 Km and 10 Km buffer around the Forest boundary. We classified all gages within the buffer as being on NFS lands.

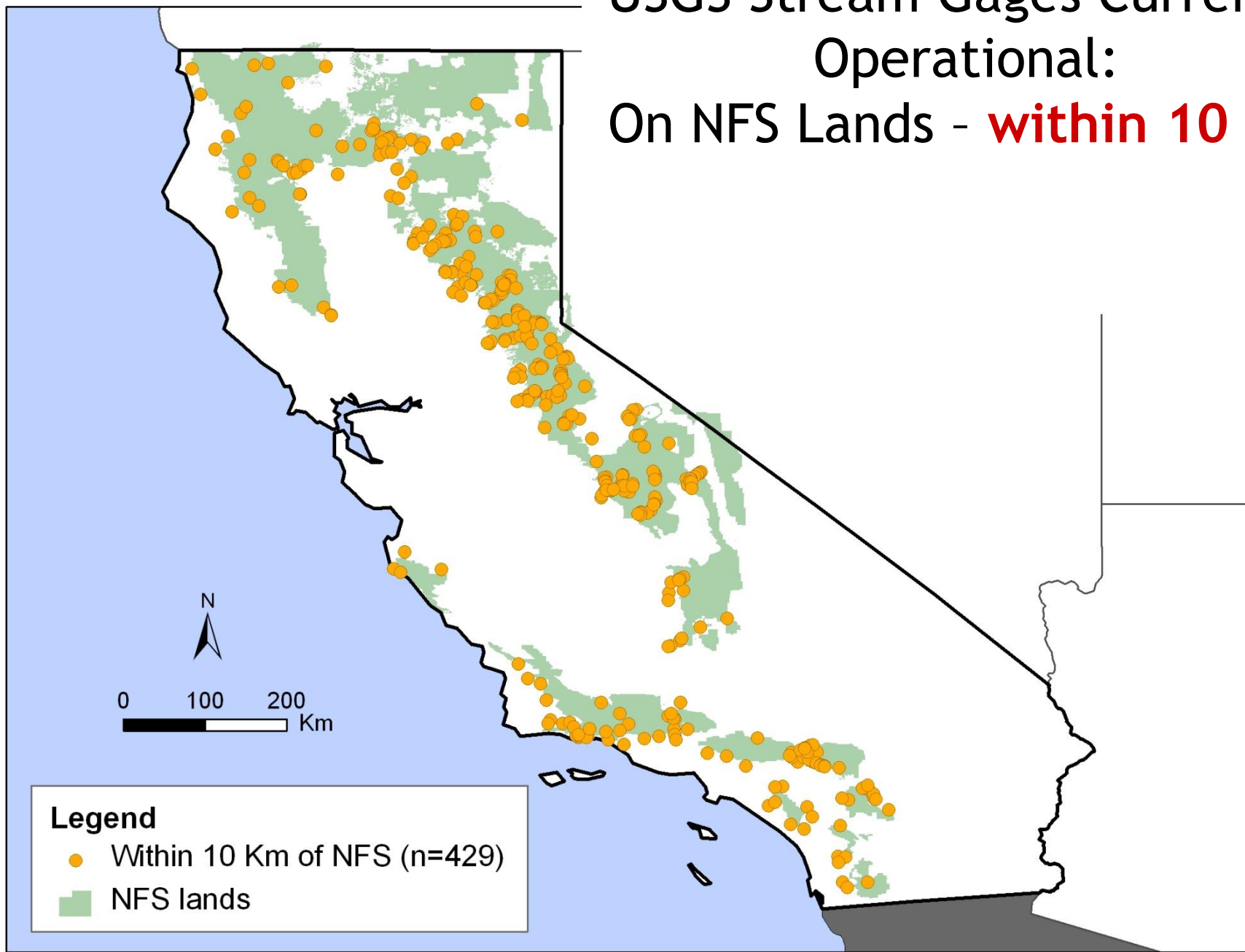
USGS Stream Gages Currently Operational: On NFS Lands - **no buffer**



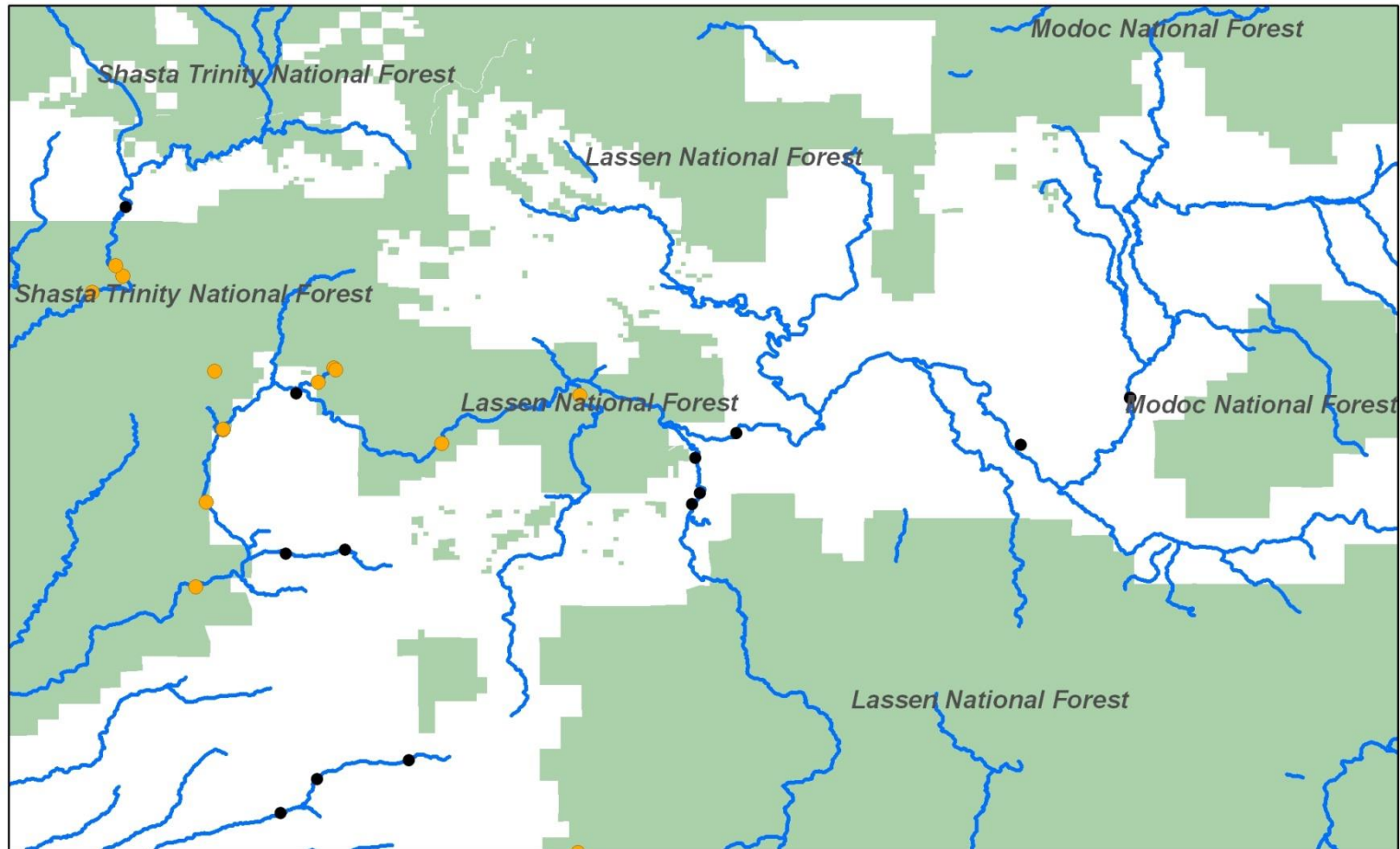
USGS Stream Gages Currently Operational: On NFS Lands - **within 1 Km**



USGS Stream Gages Currently Operational: On NFS Lands - **within 10 Km**



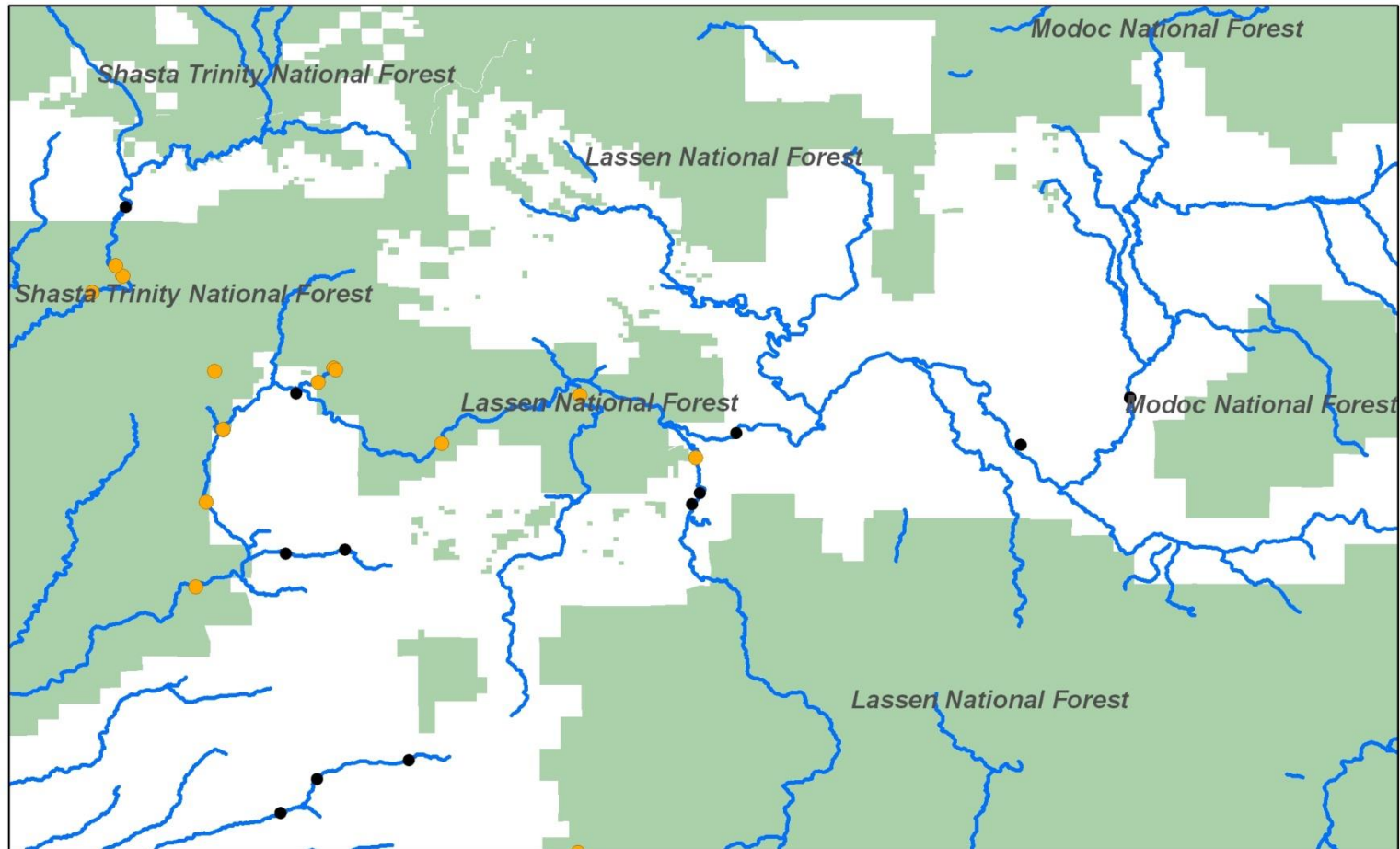
USGS Stream Gages Currently Operational: On NFS Lands - **No Buffer**



Legend

- No buffer
- Not on NFS lands
- NFS lands

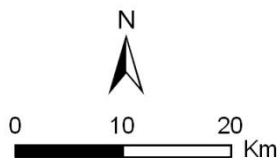
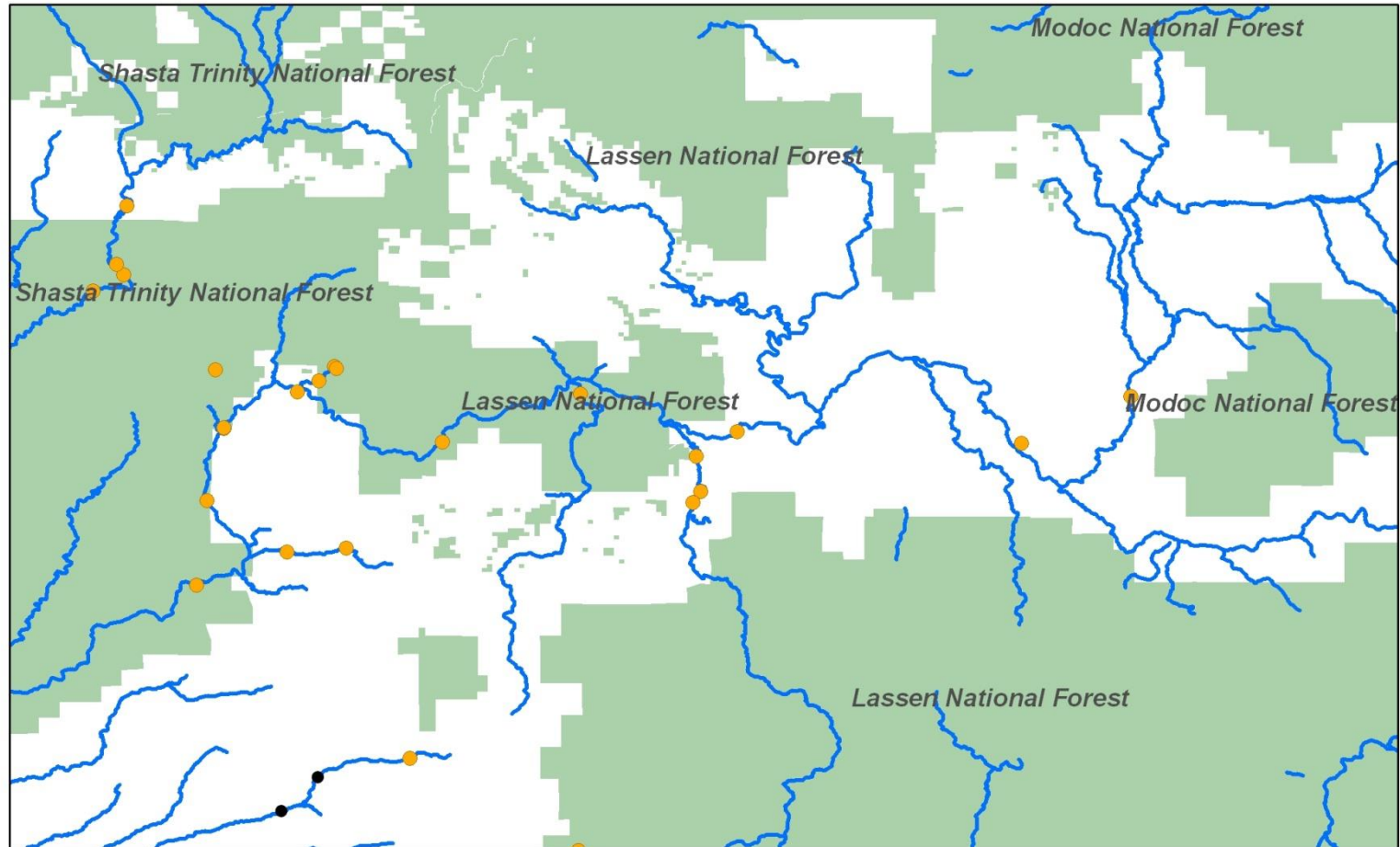
USGS Stream Gages Currently Operational: On NFS Lands - **Within 1 Km**



Legend

- Within 1 Km of NFS
- Not on NFS lands
- NFS lands

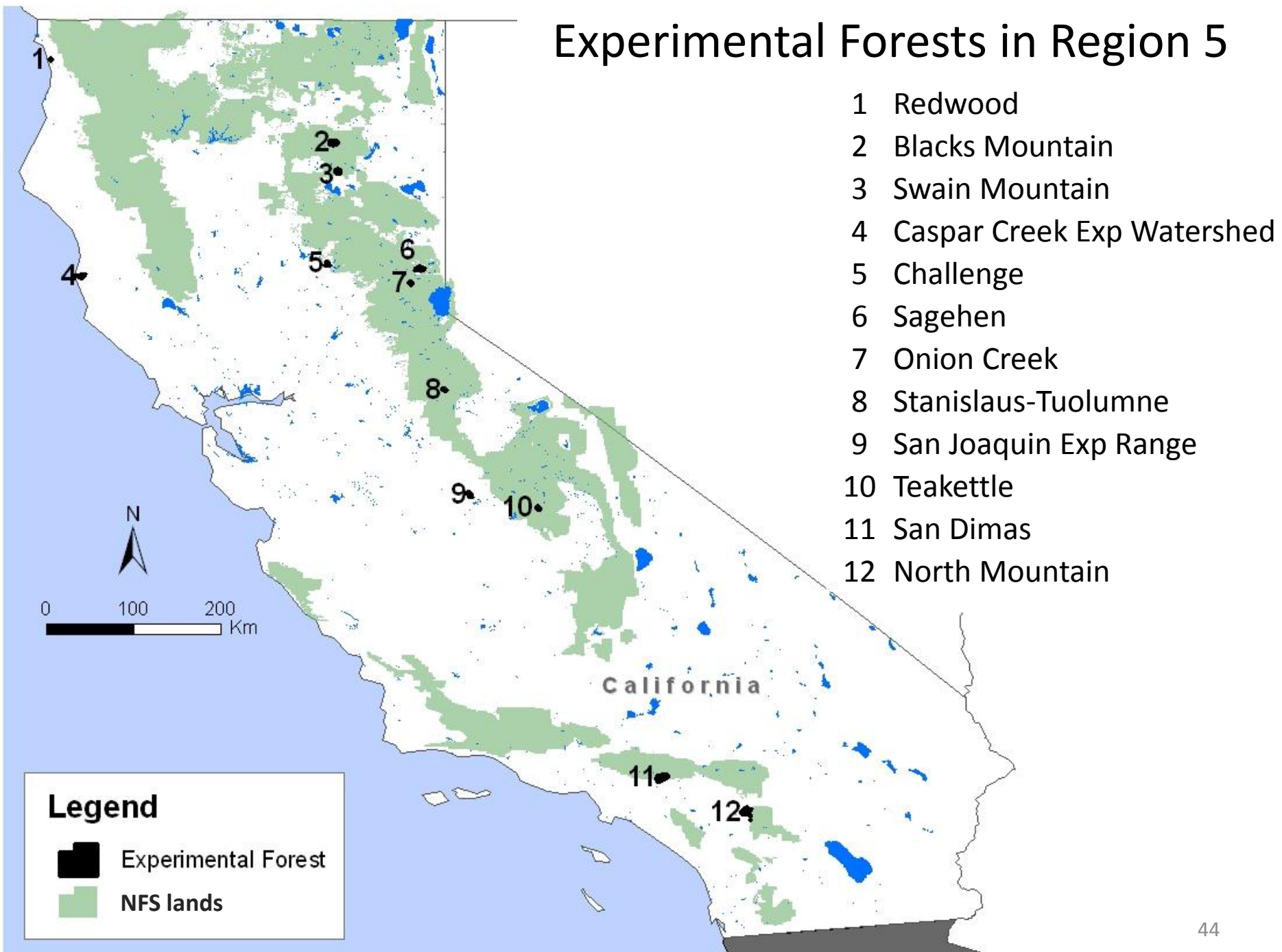
USGS Stream Gages Currently Operational: On NFS Lands - **Within 10 Km**



Legend

- Within 10 Km of NFS
- Not on NFS lands
- NFS lands

Experimental Forests in Region 5



Klamath River Estuary, photo credit NPS

